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CLUB NEWS

Minutes of the San Diego Shell Club Meeting - November 19, 1998

President Wes Farmer called the meeting to order. The minutes of the October meeting were approved as published in *The Festivus*. The money for the club Christmas party is due by December 1st. The announcement was made that the store "The Sea" in San Pedro is closed but still has discounted merchandise. Dave Mulliner offered two hand dredges to anyone who wanted them. (They were quickly scooped up.) There were also books available for sale at the back of the room with proceeds to benefit the Club library.

Wes presented the slate of officers for 1999: President: Terry Arnold; Vice President: Mike Mason; Corresponding Secretary: Kim Hutsell; Recording Secretary: Silvana Vollero; Treasurer: Linda Hutsell. There were no nominations from the floor and the candidates were elected unanimously. The installation of officers will be at the Club Christmas Party.

Don Shasky introduced the speaker for the evening, Daniel Geiger, who discussed the topic of his dissertation, the systematics of the abalone. He spoke about the problems in trying to distinguish species and explained the very complex relationships among the species in a clear, understandable way. He said that the Haliotidae originated in the Indo-Pacific and he mentioned some of the characters that have been used in classifying them such as the number of open holes, their roundedness and the radulae. It was interesting to note that pea crabs have been found in abalone shells. He had very fine slides and his program was greatly enjoyed by the large audience.

Refreshments for the evening were provided by Billee Gerrodette (formerly Brown) and Twila & Tom Critchlow, and the winner of the shell drawing was Marge Lindahl. The meeting was adjourned at 8:50 p.m. to enjoy the refreshments, view the shell display and listen to Daniel as he identified the many abalone that were brought in.

Silvana Vollero

Dues are Due

This is the last issue of *The Festivus* that you will receive if your dues have not been paid. For amount of dues and Club address, see masthead on the first page.

The Annual Club Christmas Dinner Party

The Club's annual Christmas Party was once again held at the Sheraton Four Points Hotel on Saturday evening December 5th. Although the turnout was somewhat smaller than usual, the party was a huge success.

A lovely Christmas tree at the entrance to the room greeted those attending, and the tables were gaily decorated in red and white with centerpieces of *Strombus gigas*, donated by Don Pisor, and planted with poinsettias. After the social hour, attendees were welcomed by Master of Ceremonies Jules Hertz and everyone sat down to enjoy a delicious meal accompanied by wines supplied by the Club and a sinful chocolate yule log for dessert.

Following dessert, Jules began the evening program with some very funny stories. He thanked the 1998 Club officers for their work and installed the new board. New president Terry Arnold was presented the gavel and charter members plaque. Wes Farmer, 1998 president, thanked his board and Carole Hertz announced to the members that *The Festivus* will enter its 30th year of continuous publication in 1999. She thanked the members for their support, especially Dave Mulliner for his excellent photography and helpfulness and *The Festivus* business manager and her husband, Jules, for his constant help and encouragement.

A slide show followed with images shown by Wes Farmer, Dave Mulliner and guest Joyce Gemmell. Joyce, a former member, showed slides of the early days in the San Felipe area: downtown San Felipe in the 60s, unloading cattle in the water in downtown San Felipe, the old horrible road to San Luis Gonzaga and Bahía San Luis Gonzaga. Her stories accompanying the slides were wonderful and were greatly enjoyed.

The traditional gift exchange followed with members selecting gifts from under the tree - always a highlight of the party. It was just a wonderful evening.

A Shell Collection Donated to the Club

A generous donation of the shell collection of the late Doris Brosius, formerly a Club member, was made by her husband George. This large collection will be sold at Club auction(s) and its proceeds will benefit *The Festivus* and other Club projects.

NOT ALL SHELLS IN BAJA CALIFORNIA ARE RECENT

(A New Listing of Molluscan Fossil Species From the Mulegé Formation and Environs)

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The little town of Mulegé, Baja California Sur, México, lies 600 miles south of the California border (Figure 1). It is a desert oasis situated under palms planted by Jesuit missionaries almost 300 years ago. Río Mulegé runs through town and culminates two miles downstream in an estuary where the drowned river mouth meets the Golfo de California. Beautiful and interesting seashells can be found washed up on the beaches and other species may often be observed alive at low tide. But not all of the shells in the Mulegé area are Recent!

The coastal plain near Mulegé represents a late Pleistocene marine terrace that has been dated at approximately 125,000 years B.P. and has been named the Mulegé Terrace (Ashby & Minch, 1987). Pleistocene sediments in the Mulegé area were deposited in small coastal embayments, similar to the small bays and other indentations now existing along the western shore of the Golfo de California (Durham, 1950). The terrace sediments contain many of the same species of shells that we see living today. The fauna therein indicates a variety of environments, including open rocky shoreline, protected sandy shoreline and estuarine.

Horizons of fossiliferous sediments overlying the Mulegé Terrace are located several meters above the level of the present day shoreline. On the exposed side of these layers of fossil shells there forms a talus slope resulting from the forces of gravity and erosion.

It has been the good fortune of my husband Bill and I to collect, prepare and study a large number of specimens from the abundant fossil assemblages in the Mulegé area of Baja California Sur on numerous visits over the last fifteen years, often with other curious cooperating collectors. Beside many happy hours of field collecting which have produced a substantial collection of fossil fauna from these localities, we have enjoyed realizing the very large degree of correlation between these 125,000 year old fossil species and the

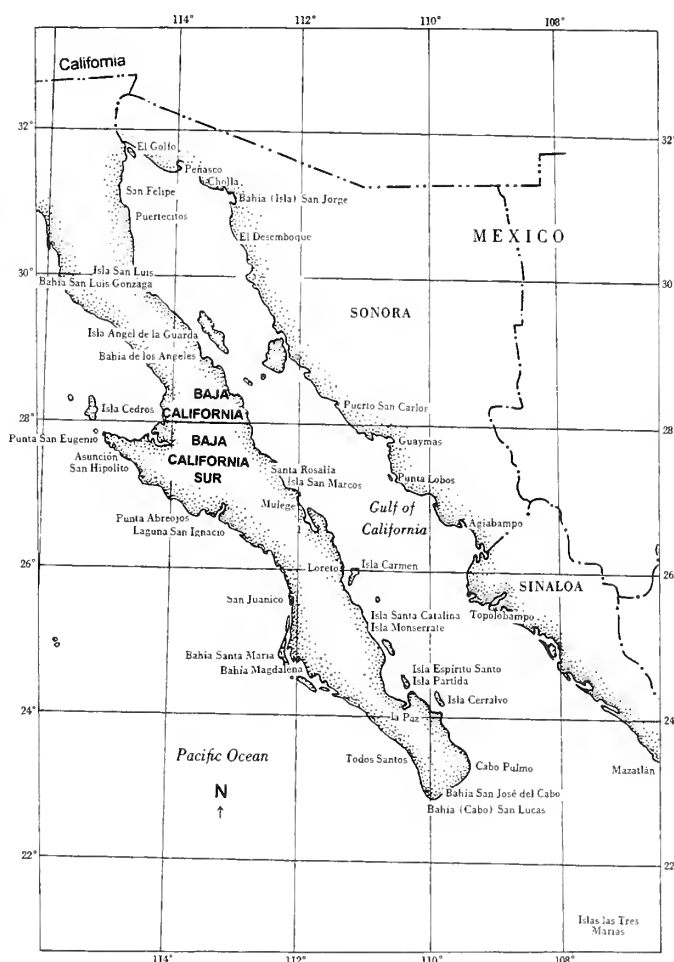


Figure 1. Mexican states of Baja California, Sonora and Sinaloa, surrounding the Golfo de California (after Keen, 1971). Pertinent localities are indicated in the text.

present day population of marine species living in the intertidal and offshore waters of Mulegé in the Golfo de California (Figure 2). We are also pleased to now be able to contribute a new and more extensive listing of identified fossil species from the Mulegé Terrace and

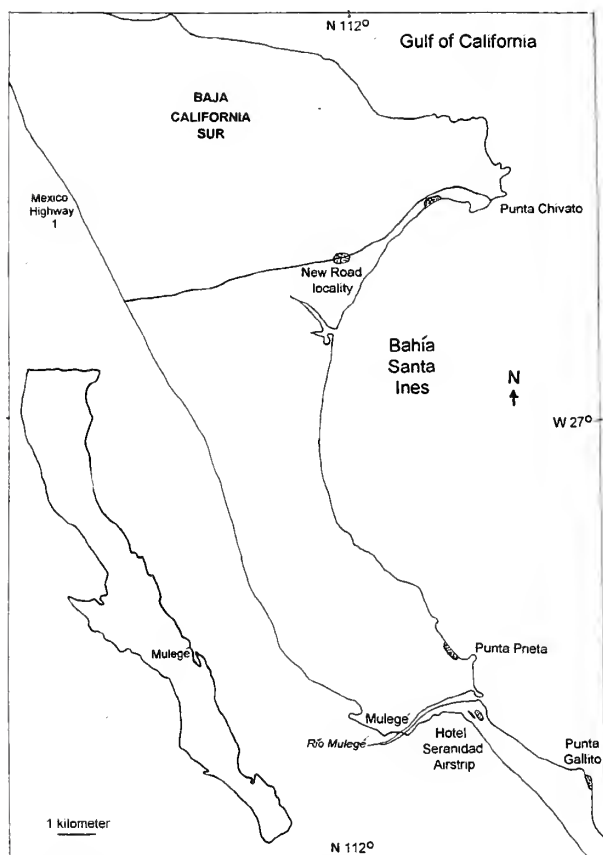


Figure 2. Distribution of fossil localities of Mulegé Formation plus two additional sites near Bahía Santa Ines. Approximate location of new road to Punta Chivato.

from nearby suspected equivalent localities. Three localities for the Mulegé Terrace were named by Ashby & Minch (1987) and are included in this report. They are as follows:

Furthest south lies the type locality which is directly south of Punta Gallito, a point 3.5 kilometers southeast of the mouth of Río Mulegé, at a GPS reading of $26^{\circ}51.744'N$, $111^{\circ}54.784'W$. This locality (Locality 1 in Table 1) contains a fauna that indicates an intertidal sandy substrate that was near a rocky area (Ashby & Minch, 1987) (Figure 3).

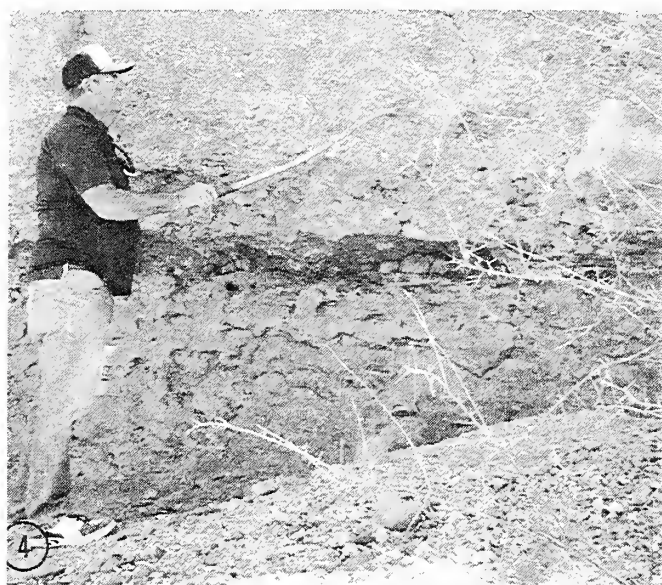
Just 0.6 kilometers south of the mouth of Río Mulegé, directly east of the Hotel Serenidad airstrip, lies another exposure of the Mulegé Terrace (Locality 2 in Table 1), indicating a shallow arm of the Mulegé estuary during the Late Pleistocene (Ashby & Minch, 1987) (Figure 4).

Two and a half kilometers northwest of the mouth of Río Mulegé, exposed in sea cliffs northwest of Punta Prieta, at a GPS reading of $26^{\circ}54.849'N$, $111^{\circ}57.709'W$, approximately 25 ft altitude and overlooking the Golfo de California, lies another exposure of the Mulegé Terrace (Locality 3 in Table 1). It indicates a slightly offshore, cobble and sand substrate (Ashby & Minch, 1987) (Figures 5, 6).

We have collected extensively in two additional Pleistocene deposits around the headlands of Punta Prieta into the next bay, just north of these described Mulegé Terrace locations. I am suggesting in this report that these two additional localities south of Punta Chivato might be considered equivalent to the Mulegé



Figure 3. Late Pleistocene Mulegé Formation exposed at Punta Gallito, now becoming covered with blowing dune sand. Type locality of Mulegé Formation (Ashby & Minch, 1987). Photo: N. Schneider.



Figures 4-7. (4) Late Pleistocene Mulegé Formation exposure east of Hotel Serenidad airstrip. Fossils eroded from exposed formation, forming a talus slope. (5) Late Pleistocene Mulegé Formation exposed on sea cliffs north of Punta Prieta. Note fossils eroded out of formation forming talus slope. (6) Closeup view of exposed cobbles and fossil assemblage with *Dosinia ponderosa*. (7) Late Pleistocene marine terrace exposed at headland at north end of Bahía Santa Ines near Punta Chivato. Photos: N. Schneider.



Figure 8. Closeup of fossilized oyster reef at the location shown in Figure 7. Photo: N. Schneider.

Formation.

One of these localities (Locality 4 in Table 1) is the marine terrace near the Punta Chivato headland at the north end of Bahía Santa Ines, 18 kilometers north of the mouth of Río Mulegé, at a GPS reading of 27°04.115'N, 112°58.537'W (Figures 7, 8). Durham (1950) published an extensive study of the Pleistocene fossils collected at this locality while on an expedition to the Golfo de California on the schooner *E. W. Scripps* in 1940. This deposit has also been studied by Hertlein (1957) who reported species to be late Pleistocene in age, since only one or two species found were extinct. Egan (1973) studied this area (see Figure 7), reporting that the marine terrace is up to 3,500 feet wide and presently 14 to 25 feet above sea level; the deposit containing an in-place assemblage of near-shore fossils that are easily recognized. Egan further reported that several un-named localities along the western side of the Golfo de California seem to correlate well with the terrace deposits at Punta Chivato.

Nearby, to the southwest, another locality (Locality 5 in Table 1) has recently been exposed during the bulldozing of a new road through the desert. A road-material quarry now exists at a GPS reading of 27°02.693'N, 112°01.773'W, approximately 40 ft in altitude. Because of the newness of the site's

accessibility, it has been visited by us only once (Figure 2). In all probability additional molluscan species will be observed on future visits.

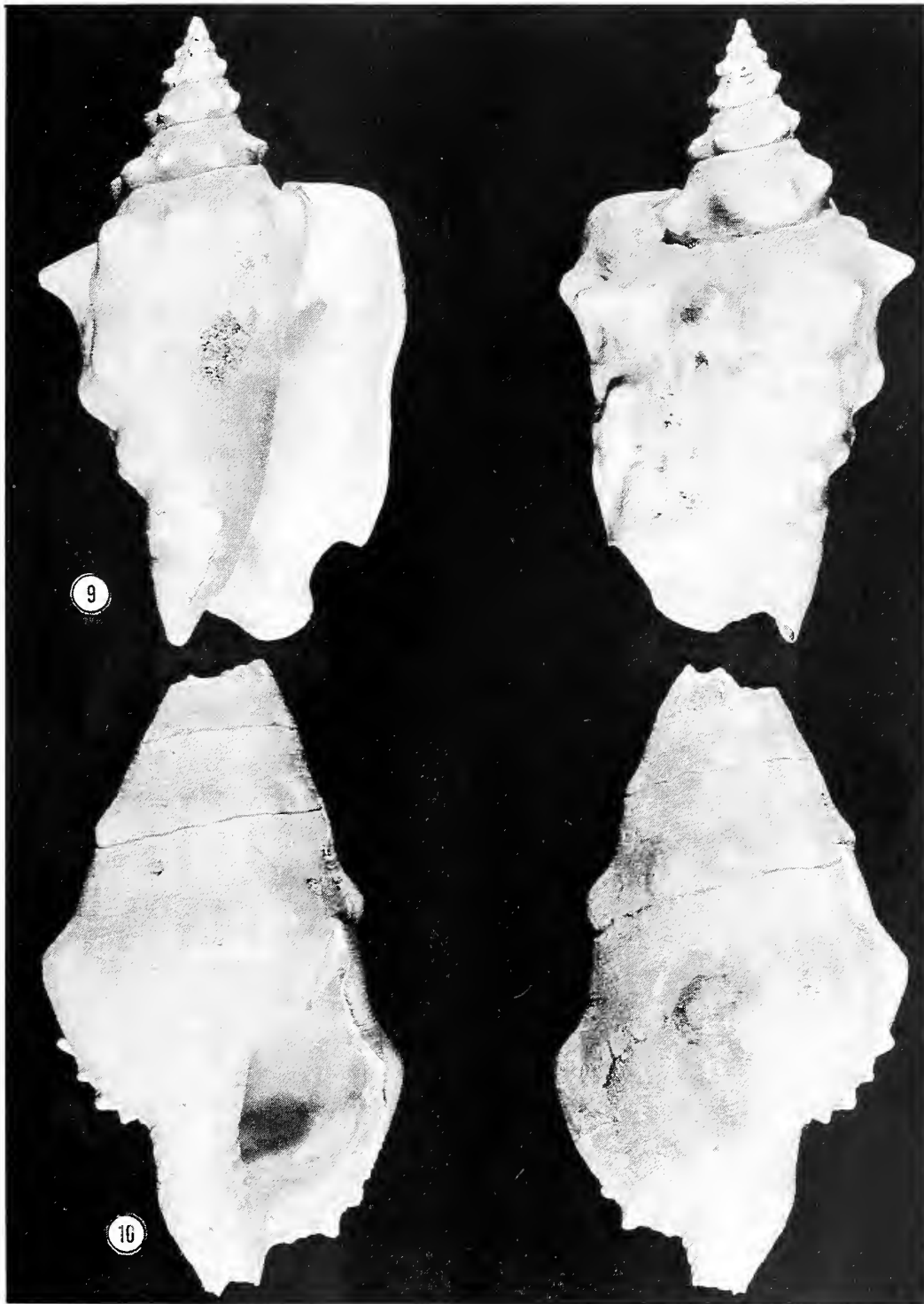
I suggest that these two additional localities might be included in reporting the fossil fauna of the Mulegé Formation for the following reasons:

First, specimens from these two localities fit within the lists of faunal material described from the Mulegé Formation, including the extinct *Strombus granulatus acutus*, *Gyrineum strongi* and *Cancellaria coronadosensis*. And second, the geologic formation appears to be equivalent in terms of sediments (including the underlying brown silty sandstone of Pliocene age). Third, the height of the marine terrace corresponds to that of the Mulegé Formation. Indeed, Ashby & Minch (1987) described a resemblance between the sediments on Punta Concepción and the Mulegé Terrace. Finally, the presence of many paired bivalves, indicative of little transport, are found at all five localities.

Other sites indicative of Pleistocene fossil mollusk assemblages have been observed in this area but are not reported here. Possibly they may prove to be a part of this same ecosystem. Desert conditions of this area are conducive to exposing these locales to even the casual bystander.

On the exposed side of the layers of fossil shells, we have collected 207 species of marine mollusks (135 gastropods, 70 bivalves, and 2 scaphopods) from the three described localities of the Mulegé Terrace plus the two additional sites near Punta Chivato. Echinoids, bryozoan and corals were also collected. Three of the gastropods, *Strombus granulatus acutus* (Figure 9), *Gyrineum strongi* (Figure 10) and *Cancellaria coronadosensis* (Figure 11), are extinct forms (Durham, 1950). *Oliva davisae*, considered extinct by Durham, has subsequently been reported by Petuch and Sargent (1986) from deeper water in the Golfo de California. Durham (1950) also considered *Plicatula inezana* extinct but it has subsequently been reported living from Bahía de los Angeles, Baja California; Santa Rosalia, Baja California Sur; and Bahía San Carlos, Sonora, all in México, and Bahía Cocos in Costa Rica (Skoglund, 1991).

Identifying *Cancellaria coronadosensis* has been a challenge. Fossils, lacking color, must be identified without that criterion. Durham collected at Locality 4 (a marine terrace at north end of Bahía Santa Ines near Punta Chivato) for only one day and did not report finding any of this species. At Isla Coronado, 130



Figures 9, 10. (9) *Strombus granulatus acutus* Durham, 1950, two views of specimen 60.7 mm H x 33.5 mm W. Extinct, late Pleistocene, Mulege Formation. Marine terrace at N end of Bahía Santa Ines near Mulegé, Baja California Sur, México. (10) *Gyrineum strongi* Jordan, 1936, two views of specimen 51.5 mm H (apex missing) x 30.3 mm W. Punta Gallito, near Mulegé, Baja California Sur, México. Photos: D. K. Mulliner.

kilometers south of Locality 4 he collected and named, *C. coronadosensis* during his 1940 *E. W. Scripps* cruise. We have collected many specimens from Locality 4 which match his figure and description: "Shell resembling typical living *C. obesa* but with a more inflated body whorl and a noticeable shoulder below the suture; axial ribs obsolete except in earliest whorls; spiral ribs present throughout, but not marked except last eight on base of body whorl" (Durham, 1950).

It is the opinion of Richard E. Petit of South Carolina, that our specimens of *C. coronadosensis* (Figure 11) and *C. obesa* Sowerby, 1832 (Figure 12) are the same and within the variations of living *C. obesa* and he sees no reason to separate the Pleistocene specimens from the Recent (Petit, personal communication). My identification of this species is based first on Durham's description which mentions the lack of reticulation on the body whorl and second, on Durham's figure which shows the very definitely shouldered spire and the inflated, unreticulated body whorl. Grant and Gale (1931: 612) concurred with Dall (1909: 30) when they stated, "In view of the individual variability of some species of *Cancellaria*, it is apparent the (California) species have been overnamed. It is likely that habitat has some influence on the shape of the shell and the sculpture, and possibly sexual dimorphism is a factor. It is believed that in many cases the subgeneric and minor subdivisions of *Cancellaria* will prove more artificial and confusing than natural. These latter have likewise been overnamed." Yet on the next page they named a new "variety" of *C. obesa* with the subspecific name *planospira*.

In general the living fauna of the Golfo de California is a northward extension of the Panamic Province (Steinbeck & Ricketts, 1941). Bahía Magdalena, on the Pacific coast of Baja California Sur, was previously considered to be the northern boundary of the Panamic molluscan province, which extends southward to Perú and the Galápagos Archipelago (Keen, 1971) with the Californian Province north of Bahía Magdalena to Point Conception, California. The Surian Province, extending north from Cabo San Lucas to Punta Eugenia, Baja California Sur, México, is unusual in that it is an area where Californian and Panamic provinces overlap. Californian Province species are found in exposed locales and Panamic Province species occur in localities that are protected or estuarine (Kennedy, 1998).

The peninsula of Baja California was formed in the

late Miocene and there is marked difference between the fauna of the Golfo de California and that of the outer coast of peninsular Baja California (Durham, 1950). However, there are some species living today in the Golfo de California which are indeed found on the outer coast of peninsular Baja California, or on the California coast, or even farther north. The living *Panopea* reaches its largest size and greatest numbers on the northwest coast of North America yet ranges south to Isla San Marcos, twenty kilometers north of its Pleistocene site at Locality 4. *Cryptomya californica* (Conrad, 1837) is found burrowing in shallow sand from the Alaskan Gulf to northern Perú.

However, there are no living species represented at the fossil localities near Mulegé, that range entirely north of the Surian or Panamic provinces.

Table 1 is a list of gastropods, bivalves and scaphopods collected from the known and documented Mulegé Terrace at Punta Gallito, Hotel Serenidad airstrip and the sea cliffs north of Punta Prieta. Specimens collected from the two additional localities near Punta Chivato have been listed separately because I find no scholarly source that has listed these sites as being within a named formation. Species which have not been previously reported by Ashby & Minch (1987), Durham (1950) or Egan (1973) are listed under columns titled NPR. Separate columns of NPR are used for the known Mulegé Terrace fauna (cols. 1, 2, 3) and fauna from the suspected two additional localities (cols. 4, 5). Extinct species or subspecies are indicated with an asterisk (*). Species are arranged alphabetically by genus. Keen (1971) and Skoglund (1991, 1992) have been followed for the orthography used in Table 1.

Of particular significance is a comparison of the present day shoreline fauna with that from the late Pleistocene. The fossil record confirms the similarity of fauna from both periods of time. But there are differences. The great majority of the Mulegé Terrace fossil fauna is still found living along the present day shoreline. Yet there are species that no longer range this far north (Table 2).

Note: It is popular today to criticize the amateur fossil collector even though those collectors and their collections may make significant contributions to scientific knowledge. A specimen weathered out of its strata soon becomes dust if not collected. Yet there are far too few paleontologists and there is too little funding to legitimately collect most sites of fossil accumulations. Like other non-academics, our curiosity aroused, we



Figures 11, 12. (11) *Cancellaria coronadosensis* Durham, 1950, two views of specimen 39.7 mm H x 25.1 mm W. Extinct, late Pleistocene, Mulegé Formation. Sea cliffs northwest of Punta Prieta near Mulegé, Baja California Sur, México. (12) *Cancellaria obesa* Sowerby, 1832, two views of specimen 39.7 mm H x 24.1 mm W. Late Pleistocene, same locality as *C. coronadosensis*. Photos: D. K. Mulliner.

have been fortunate to be able to make use of our time and energy to pursue our interest in these common invertebrates and submit this report.

A collection of these fossil mollusks from the Mulegé Terrace and its environs has been placed on loan at the Museo Comunitario Mulegé (Mulegé Community Museum) for display and study.

ACKNOWLEDGMENTS

I wish to thank Carole and Jules Hertz for their continual encouragement in this endeavor and for their time spent in identification of species and for editorial expertise. Yvonne Albi, Lindsey Groves, Richard E. Petit and Carol Skoglund also graciously assisted in identification. Dave Mulliner's excellent photography adds immensely to this undertaking. George Kennedy is to be thanked for his critical review of the paper. Computer assistance from Dyanna Dawson, Sean Dawson, Kelly Ann Fujita and Gregg Fujita was of great help to this novice. Late night discussions with Don Guthrie, fellow collector, clarified thinking and provided focus. Special thanks go to my collecting partner and husband, Bill Schneider.

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TABLE 1.

List of gastropods, bivalves and scaphopods collected from the Mulegé Terrace
and two additional localities near Punta Chivato, Baja California Sur, México.

X = specimens collected; * = extinct species;

NPR = not previously reported

Known Mulegé Terrace Localities

Locality 1 = Punta Gallito

Locality 2 = Hotel Serenidad airstrip

Locality 3 = sea cliffs northwest of Punta Prieta

Suspected Mulegé Formation Localities

Locality 4 = marine terrace at north end of Bahía Santa Ines near Punta Chivato

Locality 5 = marine terrace at quarry revealed by new road to Punta Chivato

Keen No.	Species	Localities						
		1	2	3	1-2-3 NPR	4	5	4-5 NPR
	BIVALVIA							
90	<i>Anadara multicostata</i> (Sowerby, 1833)	X	X	X	-	X	X	-
223	<i>Anomia peruviana</i> Orbigny, 1846	X	X	X	-	X	-	-
67	<i>Arca pacifica</i> (Sowerby, 1833)	X	X	-	-	X	-	-
99	<i>Arcopsis solida</i> (Sowerby, 1833)	X	-	-	-	X	-	-
182	<i>Argopecten ventricosus</i> (Sowerby, 1842)	X	X	X	-	X	-	-
73	<i>Barbatia alternata</i> (Sowerby, 1833)	X	-	-	X	X	-	-
71	<i>Barbatia gradata</i> (Broderip & Sowerby, 1829)	X	-	-	-	X	-	-
74	<i>Barbatia reeveana</i> (Orbigny, 1846)	X	X	-	-	X	-	-
237	<i>Carditamera affinis</i> Sowerby, 1833	-	X	-	-	X	-	-
346	<i>Chama buddiana</i> C. B. Adams, 1852	X	X	-	-	X	-	-
348	<i>Chama frondosa</i> Broderip, 1835	X	X	X	X	-	-	-
440	<i>Chione californiensis</i> (Broderip, 1835)	X	X	X	-	X	X	-
441	<i>Chione compta</i> (Broderip, 1835)	-	X	-	X	X	-	-
460	<i>Chione mariae</i> (Orbigny, 1846)	-	X	-	X	X	-	-
444	<i>Chione tumens</i> (Verrill, 1870)	X	X	X	-	X	X	X
445	<i>Chione undatella</i> (Sowerby, 1835)	X	X	X	X	X	X	-
450	<i>Chionopsis gnidia</i> (Broderip & Sowerby, 1829)	-	X	-	-	X	X	-
279	<i>Codakia distinguenda</i> (Tryon, 1872)	X	X	X	-	X	-	-
671	<i>Cryptomya californica</i> (Conrad, 1837)	-	X	X	X	X	-	-
284	<i>Ctena mexicana</i> (Dall, 1901)	-	X	-	X	X	-	-
285	<i>Divalinga eburnea</i> (Reeve, 1850)	-	-	X	-	X	-	-
584	<i>Donax californicus</i> Conrad, 1837	-	X	-	-	-	-	-
427	<i>Dosinia ponderosa</i> (Schumacher, 1817)	-	X	X	-	X	X	-
669	<i>Ensis nitidus</i> (Clessin, 1888)	-	-	X	X	-	-	-
229	<i>Eucrassatella antillarum</i> (Reeve, 1842)	-	-	-	-	X	-	-
230	<i>Eucrassatella gibbosa</i> Sowerby, 1832	-	X	-	X	-	-	-
181	<i>Euvola vogdesi</i> (Arnold, 1906)	X	X	X	-	X	-	-
75	<i>Fugleria illota</i> (Sowerby, 1833)	X	-	-	X	X	-	-
381	<i>Globivenus isocardia</i> (Verrill, 1870)	-	-	-	-	X	-	-
110	<i>Glycymeris gigantea</i> (Reeve, 1843)	X	X	X	-	X	X	-
112	<i>Glycymeris maculata</i> (Broderip, 1832)	X	X	X	X	X	-	-
164	<i>Isognomon quadratus</i> (Anton, 1837)	X	-	-	X	-	-	-

Keen No.	Species	Localities						
		1	2	3	1-2-3 NPR	4	5	4-5 NPR
378	<i>Laevicardium elatum</i> (Sowerby, 1833)	X	X	X	X	X	-	-
557	<i>Leporimetis cognata</i> (Pilsbry & Vanatta, 1902)	X	-	-	X	X	-	-
219	<i>Limaria pacifica</i> (Orbigny, 1846)	-	-	-	-	X	-	X
489	<i>Macra dolabriformis</i> (Conrad, 1867)	-	-	-	-	X	-	X
425	<i>Megapitaria squalida</i> (Sowerby, 1835)	X	X	-	-	X	-	-
287	<i>Miltha xantusi</i> (Dall, 1905)	-	-	X	X	X	-	X
149	<i>Modiolus capax</i> (Conrad, 1837)	X	X	X	-	X	X	-
167	<i>Myrakeena angelica</i> (Rochebrune, 1895)	X	X	X	-	X	-	-
202	<i>Nodipecten subnodosus</i> (Sowerby, 1835)	X	-	X	-	X	X	-
699	<i>Pandora cornuta</i> C. B. Adams, 1852	-	-	-	-	X	-	X
738	<i>Panopea</i> sp. aff. <i>P. abrupta</i>	-	-	-	-	X	X	-
288	<i>Pegophysema edentuloides</i> (Verrill, 1870)	-	-	-	-	X	-	-
380	<i>Periglypta multicostata</i> (Sowerby, 1835)	X	-	-	X	-	-	-
162	<i>Pinctada mazatlanica</i> (Hanley, 1856)	X	-	X	X	-	-	-
156	<i>Pinna rugosa</i> Sowerby, 1835	X	-	-	-	X	X	-
224	<i>Placunanomia cumingii</i> Broderip, 1832	-	-	-	-	X	-	-
207	<i>Plicatula inezana</i> Durham, 1950	X	-	X	X	X	X	-
572	<i>Psammotrete viridotincta</i> (Carpenter, 1856)	-	X	-	X	-	-	-
--	<i>Pseudochama exogyra</i> (Conrad, 1837)	X	X	X	X	-	-	-
505	<i>Raeta undulata</i> (Gould, 1851)	-	-	-	-	X	-	-
23	<i>Saccella elenensis</i> (Sowerby, 1833)	-	X	-	X	X	-	-
168	<i>Saccostrea columbiensis</i> (Hanley, 1846)	-	X	-	X	-	-	-
174	<i>Saccostrea palmula</i> (Carpenter, 1857)	X	X	X	-	-	-	-
630	<i>Semele flavescens</i> (Gould, 1851)	X	X	-	-	-	-	-
637	<i>Semele verrucosa pacifica</i> Dall, 1915	X	-	-	X	-	-	-
--	<i>Solen rostriformis</i> Dunker, 1862	-	-	-	-	X	-	-
210	<i>Spondylus calcifer</i> Carpenter, 1857	X	-	-	-	X	-	-
244	<i>Strophocardia megastropa</i> (Gray, 1825)	-	-	-	-	X	-	-
616	<i>Tagelus californianus</i> (Conrad, 1837)	-	X	-	-	X	X	-
--	<i>Tellina bodegensis</i> Hinds, 1845	-	-	-	-	X	-	X
551	<i>Tellina cumingii</i> Hanley, 1844	-	X	X	-	X	-	-
535	<i>Tellina simulans</i> C. B. Adams, 1852	-	X	-	X	X	-	-
385	<i>Tivela byronensis</i> (Gray, 1838)	-	X	X	-	X	-	-
370	<i>Trigoniocardia biangulata</i> (Broderip & Sowerby, 1829)	X	X	X	-	X	-	-
360	<i>Trachycardium consors</i> (Sowerby, 1833)	X	X	X	-	X	-	-
363	<i>Trachycardium panamense</i> (Sowerby, 1833)	-	X	-	-	X	-	-
364	<i>Trachycardium procerum</i> (Sowerby, 1833)	-	-	-	-	X	-	-
116	<i>Tucetona multicostata</i> (Sowerby, 1833)	-	-	X	-	X	-	-
GASTROPODA								
1082	<i>Acanthina lugubris angelica</i> I. Oldroyd, 1918	-	-	-	-	X	-	X
1614	<i>Agladrillia pudica</i> (Hinds, 1843)			X	X			
1458	<i>Aphera tessellata</i> (Sowerby, 1832)	-	-	X	X	-	-	-
425	<i>Architectonica nobilis</i> Röding, 1798	X	X	X	-	X	X	-

Keen No.	Species	Localities						
		1	2	3	1-2-3 NPR	4	5	4-5 NPR
157	<i>Astraea unguis</i> (Wood, 1828)	X	-	-	-	-	-	-
1021	<i>Attiliosa nodulosa</i> (A. Adams, 1855)	-	-	-	-	X	-	X
1020	<i>Bizetiella carmen</i> (Lowe, 1935)	-	-	X	X	-	-	-
2235	<i>Bulla gouldiana</i> Pilsbry, 1895	X	X	X	X	X	X	-
1577	<i>Calliclava aegina</i> (Dall, 1919)	-	-	-	-	X	-	X
78	<i>Calliostoma eximium</i> (Reeve, 1843)	-	X	X	X	X	X	-
801	<i>Calyptrea mamillaris</i> Broderip, 1834	-	-	-	-	-	X	-
1466	<i>Cancellaria cassidiformis</i> Sowerby, 1832	X	X	X	-	X	X	-
1463	<i>Cancellaria chrysostoma</i> Sowerby, 1832	-	-	X	X	-	-	-
--	* <i>Cancellaria coronadosensis</i> Durham, 1950	-	-	X	-	X	-	X
1452	<i>Cancellaria obesa</i> Sowerby, 1832	-	-	X	-	X	-	-
1462	<i>Cancellaria pulchra</i> Sowerby, 1832	-	-	X	X	-	-	-
1474	<i>Cancellaria solida</i> Sowerby, 1832	-	-	X	-	-	-	-
1121	<i>Cantharus macrospira</i> (Berry, 1957)	X	X	X	-	X	-	-
1122	<i>Cantharus mendozana</i> (Berry, 1959)	X	-	-	-	-	-	-
602	<i>Cerithidea californica mazatlanica</i> Carpenter, 1857	-	X	-	-	-	-	-
510	<i>Cerithium maculosum</i> Kiener, 1841	X	-	X	-	X	-	-
515	<i>Cerithium stercusmuscarum</i> Valenciennes, 1833	-	X	-	-	X	-	-
516	<i>Cerithium uncinatum</i> (Gmelin, 1791)	-	X	-	X	-	-	-
980	<i>Chicoreus erythrostomus</i> (Swainson, 1831)	X	X	X	-	X	X	-
1155	<i>Columbella fuscata</i> Sowerby, 1832	X	X	-	X	X	-	-
1158	<i>Columbella major</i> Sowerby, 1832	X	-	-	X	-	-	-
1733	<i>Compsodrillia albonodosa</i> (Carpenter, 1857)	-	X	X	X	X	-	X
1739	<i>Compsodrillia haliplexa</i> (Dall, 1919)	-	-	-	-	-	X	X
1503	<i>Conus lucidus</i> Wood, 1828	X	X	-	X	-	-	-
1513	<i>Conus patricius</i> Hinds, 1843	-	-	-	-	-	X	-
1494	<i>Conus princeps</i> Linnaeus, 1758	X	-	X	-	X	X	-
1500	<i>Conus purpurascens</i> Sowerby, 1833, ex Broderip MS	-	-	-	-	X	-	-
1507	<i>Conus regularis</i> Sowerby, 1833	X	-	X	-	X	X	-
1508	<i>Conus scalaris</i> Valenciennes, 1832	X	X	X	-	X	X	X
1517	<i>Conus ximenes</i> Gray, 1839	X	-	X	X	X	X	-
1217	<i>Cosmioconcha palmeri</i> (Dall, 1913)	-	-	X	X	-	-	-
1175	<i>Costoanachis coronata</i> (Sowerby, 1832)	-	-	X	X	-	-	-
1702	<i>Crassispira xanti</i> Hertlein & Strong, 1951	-	-	-	-	X	-	X
810	<i>Crepidula excavata</i> (Broderip, 1834)	-	X	X	X	X	X	X
814	<i>Crepidula onyx</i> Sowerby, 1824	-	X	-	X	-	-	-
815	<i>Crepidula perforans</i> (Valenciennes, 1846)	-	X	-	X	-	-	-
817	<i>Crepidula striolata</i> Menke, 1851	X	-	X	-	-	-	-
967	<i>Crossata californica sonarana</i> (Berry, 1960)	-	-	-	-	X	-	-
828	<i>Crucibulum concameratum</i> Reeve, 1859	-	-	-	-	X	-	X
822	<i>Crucibulum lignarium</i> (Broderip, 1834)	X	-	-	X	-	-	-
825	<i>Crucibulum scutellatum</i> (Wood, 1928)	X	X	X	-	X	X	-
826	<i>Crucibulum spinosum</i> (Sowerby, 1824)	-	X	X	-	-	X	-
961	<i>Cymatium gibbosum</i> (Broderip, 1833)	X	-	X	X	X	-	X

Keen No.	Species	1	2	3	1-2-3 NPR	4	5	4-5 NPR
958	<i>Cymatium lineatum</i> (Broderip, 1833)	-	-	-	-	X	-	X
947	<i>Cypraecassis coarctata</i> (Sowerby, 1825)	X	-	X	-	X	-	-
15	<i>Diodora alta</i> (C. B. Adams, 1852)	X	X	-	X	X	-	-
--	<i>Drillia</i> sp.			X	X			
1353	<i>Enaeta cumingii</i> (Broderip, 1832)	X	X	X	-	-	-	-
--	<i>Epitonium indianorum</i> (Carpenter, 1864)	-	-	X	X	-	-	-
1024	<i>Eupleura muriciformis</i> (Broderip, 1833)	-	X	-	-	-	-	-
952	<i>Ficus ventricosa</i> (Sowerby, 1825)	-	-	X	X	-	-	-
1346	<i>Fusinus ambustus</i> (Gould, 1853)	X	-	X	X	-	-	-
1342	<i>Fusinus cinereus</i> (Reeve, 1847)	-	-	X	X	-	-	-
1340	<i>Fusinus dupetitthouarsi</i> (Kiener, 1840)	X	X	X	-	X	-	-
--	* <i>Gyrineum strongi</i> Jordan, 1936	X	-	X	-	X	-	-
--	<i>Haustellum ruthae</i> (Vokes, 1988)	-	-	X	-	X	-	-
1001	<i>Hexaplex nigritus</i> (Philippi, 1845)	-	X	-	X	X	-	X
766	<i>Hipponix antiquatus panamensis</i> C. B. Adams, 1852	X	X	X	X	X	-	-
765	<i>Hipponix grayanus</i> Menke, 1853	X	X	X	-	X	-	X
1575	<i>Hormospira maculosa</i> (Sowerby, 1834)	-	X	-	X	X	-	-
940	<i>Jenneria pustulata</i> [Lightfoot, 1786]	-	-	X	X	-	-	-
1656	<i>Knefastia dalli</i> Bartsch, 1944	X	-	X	-	-	-	-
517	<i>Liocerithium judithae</i> Keen, 1971	X	-	-	-	X	-	-
925	<i>Macrocypraea cervinetta</i> (Kiener, 1843)	X	-	-	X	-	-	-
942	<i>Malea ringens</i> (Swainson, 1822)	-	X	X	-	X	-	X
1096	<i>Mancinella tuberculata</i> (Sowerby, 1835)	X	X	X	X	-	-	-
927	<i>Mauritia arabicula</i> (Lamarck, 1811)	X	-	X	X	-	-	-
1290	<i>Melongenella patula</i> (Broderip & Sowerby, 1829)	-	X	X	-	X	-	-
1007	<i>Muricopsis zeteki</i> Hertlein & Strong, 1951	X	-	X	X	-	-	-
1317	<i>Nassarius complanatus</i> (Powys, 1835)	-	X	-	X	X	-	-
1307	<i>Nassarius nodicinctus</i> (A. Adams, 1852)	X	-	-	X	X	-	-
1321	<i>Nassarius tiarula</i> (Kiener, 1841)	-	X	X	X	X	-	-
1314	<i>Nassarius versicolor</i> (C. B. Adams, 1852)	-	X	X	X	X	-	-
1315	<i>Nassarius wilsoni</i> (C. B. Adams, 1852)	-	-	X	X	-	-	-
870	<i>Natica broderipiana</i> Récluz, 1844	-	-	-	-	-	X	X
871	<i>Natica elenae</i> Récluz, 1844	X	-	-	X	-	-	-
1095	<i>Neorapana muricata</i> (Broderip, 1832)	-	X	X	-	-	-	-
166	<i>Nerita funiculata</i> Menke, 1851	X	X	-	X	X	-	-
165	<i>Nerita scabricosta</i> Lamarck, 1822	-	X	X	-	X	X	-
888	<i>Neverita reclusiana</i> (Deshayes, 1839)	X	X	X	-	X	X	-
1363	<i>Oliva davisae</i> Durham, 1950	X	-	-	X	X	-	-
1360	<i>Oliva incrassata</i> [Lightfoot, 1786]	X	X	X	-	X	X	-
1364	<i>Oliva porphyria</i> (Linnaeus, 1758)	X	-	-	X	X	-	-
1365	<i>Oliva spicata</i> (Röding, 1798)	X	X	X	-	X	X	-
1377	<i>Olivella dama</i> (Wood, 1828, ex Mawe MS)	X	X	X	-	X	X	-
1379	<i>Olivella gracilis</i> (Broderip & Sowerby, 1829)	X	X	X	X	X	-	-
1261	<i>Parametaria dupontii</i> (Kiener, 1849-50)	X	-	X	X	-	-	-
1092	<i>Pascula ferruginosa</i> (Reeve, 1846)	X	X	-	X	-	-	-
496	<i>Petalconchus flavescens</i> (Carpenter, 1857)	X	X	-	X	-	-	-

Keen No.	Species	1	2	3	1-2-3 NPR	4	5	4-5 NPR
1142	<i>Phos</i> cf. <i>gaudens</i> Hinds, 1844			X	X			
873	<i>Polinices bifasciatus</i> (Griffith & Pidgeon, 1834)	X	X	X	X	X	X	-
879	<i>Polinices otis</i> (Broderip & Sowerby, 1829)	-	-	-	-	-	X	X
880	<i>Polinices panamaensis</i> (Récluz, 1844)	-	-	-	-	X	-	X
882	<i>Polinices uber</i> (Valenciennes, 1832)	X	X	X	-	X	X	X
1574	<i>Pseudomelasma penicillata</i> (Carpenter, 1864)	-	-	X	X	-	-	-
1036	<i>Pteropurpura erinaceoides</i> (Valenciennes, 1832)	X	X	X	X	X	-	-
506	<i>Rhinoclavis gemmatum</i> (Hinds, 1844)	-	-	X	-	X	-	-
948	<i>Semicassis centiquadrata</i> (Valenciennes, 1832)	-	-	X	-	X	-	-
503	<i>Serpulorbis margaritaceus</i> (Chenu, 1844, ex Rousseau MS)	X	-	-	-	-	X	X
1273	<i>Sincola gibberula</i> (Sowerby, 1832)	-	-	-	-	X	-	X
1076	<i>Stramonita haemostoma</i> (Linnaeus, 1758)	X	X	-	-	-	-	-
1277	<i>Strombina maculosa</i> (Sowerby, 1832)	X	-	X	-	X	-	-
609	<i>Strombus galeatus</i> Swainson, 1823	X	-	-	-	X	X	-
607	<i>Strombus gracilior</i> Sowerby, 1825	X	X	X	-	X	X	-
608	<i>Strombus granulatus</i> Swainson, 1822	-	X	-	-	-	X	-
--	* <i>Strombus granulatus acutus</i> Durham, 1950	X	-	X	X	X	-	-
1443	<i>Subcancilla phorminx</i> (Berry, 1969)	-	-	X	X	-	-	-
1444	<i>Subcancilla sulcata</i> (Swainson in Sowerby, 1825)	-	-	X	X	-	-	-
105	<i>Tegula mariana</i> Dall, 1919	X	X	-	X	X	-	-
94	<i>Tegula rugosa</i> (A. Adams, 1853)	-	X	-	-	-	-	-
1543	<i>Terebra intertincta</i> Hinds, 1844	-	-	X	X	-	-	-
1555	<i>Terebra panamensis</i> Dall, 1908	-	X	-	X	X	-	-
1560	<i>Terebra robusta</i> Hinds, 1844	X	-	-	X	-	-	-
1565	<i>Terebra specillata</i> Hinds, 1844	-	X	X	X	X	-	-
1566	<i>Terebra strigata</i> Sowerby, 1825	X	X	-	X	X	-	-
1571	<i>Terebra variegata</i> Gray, 1834	X	X	X	-	X	X	-
168	<i>Theodoxus luteofasciatus</i> (Miller, 1879)	-	X	-	-	-	-	-
910	<i>Trivia solandri</i> (Sowerby, 1832, ex Gray MS)	X	X	X	-	X	-	-
144	<i>Turbo fluctuosus</i> Wood, 1828	X	X	X	-	X	-	-
149	<i>Turbo squamiger</i> Reeve, 1843	-	-	X	X	-	X	-
434	<i>Turritella banksi</i> Reeve, 1849	X	X	X	X	X	-	-
437	<i>Turritella clarionensis</i> Hertlein & Strong, 1951	X	X	-	X	X	X	X
439	<i>Turritella lentiginosa</i> Reeve, 1849	-	-	X	X	X	-	-
440	<i>Turritella leucostoma</i> Valenciennes, 1832	-	-	-	-	X	-	-
442	<i>Turritella nodulosa</i> King & Broderip, 1832	-	-	X	-	X	-	-
1397	<i>Vasum caestus</i> (Broderip, 1833)	X	X	X	-	X	-	-
494	<i>Vermetus indentatus</i> (Carpenter, 1857)	X	X	-	X	X	-	-
449	<i>Vermicularia pellucida eburnea</i> (Reeve, 1842)	X	-	X	X	X	-	-
448	<i>Vermicularia pellucida pellucida</i> (Broderip & Sowerby, 1829)	X	-	-	X	-	-	-
933	<i>Zonaria annettae</i> (Dall, 1909)	X	X	X	-	X	X	-
	SCAPHOPODA							
--	<i>Dentalium</i> spp (2 species)			X				

Table 2.

List of mollusk species found in Mulegé Terrace sediments,
that no longer are found at Mulegé, and their present northernmost endpoint.

<i>Astraea unguis</i> - Guaymas, Sonora, México	<i>Phos</i> cf. <i>gaudens</i> - Bahía Escondido, Baja California, México
<i>Cancellaria chrysostoma</i> - Panamá	<i>Pseudomelatoma penicillata</i> - Buena Vista, Baja California Sur, México
<i>Cancellaria pulchra</i> - Guaymas, Sonora, México	<i>Serpulorbis margaritaceus</i> - La Paz, Baja California Sur, México
<i>Crassispira xanti</i> - Punta Lobos, Sonora, México	<i>Turritella banksi</i> - Guaymas, Sonora, México
<i>Cymatium lineatum</i> - Islas Galápagos, Ecuador	<i>Vasum caestus</i> - La Paz, Baja California Sur, and Guaymas, Sonora, México
<i>Hipponix grayanus</i> - Mazatlán, Sinaloa, México	<i>Vermicularia pellucida pellucida</i> - Topolobampo, Sinaloa, México
<i>Miltha xantusi</i> - La Paz, Baja California Sur, México	
<i>Nassarius complanatus</i> - El Salvador	
<i>Nassarius wilsoni</i> - El Salvador	
<i>Olivella gracilis</i> - Guaymas, Sonora, México	
<i>Neorapana muricata</i> - Guaymas, Sonora, México	

1999 LOW TIDES FOR THE NORTHERN GULF OF CALIFORNIA

The entries below show periods of low tides of -4.0 feet and below. The times of low tides are given in Mountain Standard Time. To correct for San Felipe, subtract one hour from listed times which are for

Puerto Peñasco (San Felipe is on Pacific Standard Time). Tides below the midriff of the Gulf cannot be estimated using these entries. All entries are approximated times and tides.

January 30	-4.5 ft at 7:00 pm	April 16	-5.5 ft at 7:30 am	July 13	-4.1 ft at 7:50 am
January 31	-4.3 ft at 8:00 pm	April 17	-5.7 ft at 8:00 am	October 24	-4.3 ft at 7:15 pm
February 15	-4.1 ft at 7:30 pm	April 18	-4.3 ft at 8:50 am	October 25	-4.5 ft at 8:00 pm
February 16	-4.4 ft at 8:00 pm	May 14	-4.7 ft at 7:00 am	October 26	-4.1 ft at 8:30 pm
February 17	-4.1 ft at 8:30 pm	May 15	-5.5 ft at 7:30 am	November 22	-5.3 ft at 7:00 pm
February 28	-4.0 ft at 7:00 pm	May 16	-5.4 ft at 8:00 am	November 23	-5.3 ft at 7:50 pm
March 16	-4.0 ft at 7:15 pm	May 17	-4.3 ft at 9:00 am	November 24	-4.7 ft at 8:15 pm
March 17	-4.6 ft at 8:00 pm	June 12	-4.2 ft at 6:15 am	December 20	-4.0 ft at 6:00 pm
March 18	-4.1 ft at 8:10 am -4.0 ft at 8:20 pm	June 13	-4.8 ft at 7:00 am	December 21	-5.2 ft at 7:00 pm
		June 14	-4.8 ft at 8:00 am	December 22	-5.7 ft at 7:30 pm
March 19	-4.2 ft at 9:00 am	June 15	-4.1 ft at 8:30 am	December 23	-5.5 ft at 8:00 pm
April 14	-4.0 ft at 7:00 pm	July 12	-4.1 ft at 7:00 am	December 24	-4.1 ft at 9:00 pm
April 15	-4.7 ft at 7:00 am -4.1 ft at 7:20 am				

BOOK NEWS

Taxonomic Atlas of the Benthic Fauna of the Santa Maria Basin and Western Santa Barbara Channel, Volume 8, The Mollusca Part 1 -- The Aplacophora, Polyplacophora, Scaphopoda, Bivalvia and Cephalopoda. Edited by Paul Valentich Scott and James A. Blake, 1998. viii + 250 pp.; ISBN 0-936494-13-1. Price: [from the Santa Barbara Museum of Natural History, 2559 Puesta del Sol Road, Santa Barbara, CA 93105]: \$39.00 plus shipping & handling (\$4.00 in the US and \$7.00 outside).

This work completes the molluscan treatment in the anticipated 14-volume set on the Fauna of the Santa Maria Basin and the Western Santa Barbara Channel, published by the Santa Barbara Museum of Natural History (the Gastropoda were covered by McLean and Gosliner in Part 2, published in 1996; see Book News in *The Festivus* 28(11): 126-127). It provides an illustrated identification manual for the mollusks occurring in the Point Conception region of southern California (ca. 35°N) and is based on soft-substrate stations sampled in 49-930 m, and hard-substrate stations sampled in 54-237 m depth.

As in the gastropod part, this work contains independent articles written by a team of taxonomic specialists. After a brief "Introduction to the Mollusca" by Eugene Coan (pp. 1-2), each article covers one molluscan class as announced in the title of the work. The drawings and black and white photographs in the various parts are generally of good quality. The work is concluded with lists and maps of station as well as a detailed index. The individual articles follow very similar general formats, usually comprising an introduction to the group, comments on collection and preservation techniques and laboratory methods, a glossary of technical terms, a list of species, dichotomous keys, the actual taxonomic treatment of the taxa encountered in the study region, and a detailed bibliography. The depth of the material presented, including excellent anatomical and morphological descriptions and careful taxonomic treatment and bibliographies make this work attractive far beyond its geographic target region (where else have authors and editors gone through the trouble of researching the author-date references for family group taxa?).

The interspersed sections on laboratory and field methods are adding particular highlights to this work: This is the place to learn the tricks of the trade from the

specialists. Amélie Scheltema explains how to collect, preserve and identify aplacophorans (you will learn a lot about birefringence of aragonite under cross-polarized light in the process...). If you find the necessary polarizing microscope too "high-tech," have a look at the Polyplacophora section: Douglas Eernisse explains what wooden tongue depressors and "strips of torn nylon hosiery" can do for malacology. Do you have problems seeing the muscle scars and pallial lines in some of your bivalve specimens? Try Paul Scott's recipe of crystal violet dye in water (and also learn how you can clean the shell from the stain afterwards...). What are useful measurements to describe a scaphopod shell? Employ the morphometric indices used by Ronald Shimek. Are you unsure about how you should "fix" a cephalopod specimen? Do you want to see the funnel organ a bit more clearly? Then try some of Eric Hochberg's tricks in the Cephalopoda section.

Amélie Scheltema's part (pages 3-47) is entitled "Class Aplacophora" and covers four species of Neomeniomorpha (traditionally known as Solenogastres) and 11 species of Chaetodermomorpha (traditionally known as Caudofoveata). Two species in the former, and three species and a genus in the latter group are described as new. It is an unusual treat to see this often-neglected molluscan group included in a regional study! Douglas Eernisse's chapter (pages 49-73) on the "Class Polyplacophora" examines the six species of Leptochitonidae, Ischnochitonidae and Mopaliidae that were collected as part of this project, and also gives information on many other taxa "likely to be encountered in the study area." Ronald Shimek's part (pages 75-96) on the "Class Scaphopoda" likewise covers the (5) species actually collected in detail and lists eight additional forms likely to be encountered in the region. As in the Polyplacophoran chapter, these "expected" additional taxa are included in the dichotomous key. Paul Valentich Scott's chapter (pages 97-173) on the "Class Bivalvia" treats 56 species, following the recently published arrangement by Coan & Scott (1997). Two species of *Rocheffortia* (Lasaeidae) are described as new and a key to the bivalve superfamilies in the Santa Barbara Channel is provided. The "Class Cephalopoda" (pages 175-236) is covered by F.G. Hochberg who gives extensive descriptions of one species of Sepiolidae, one of Loliginidae and six of Octopodidae. Two of the latter, *Benthoctopus leioderma* (Berry, 1911) and *Enteroctopus dofleini*

(Wülker, 1910), are placed in new generic combinations. The author supplemented the study by examining numerous specimens from other locations, ranging from Alaska to Mexico. In addition to extensive morphological descriptions, this section offers interesting summaries of the biology of the treated species.

This volume is another "must have" for anybody interested in the Californian mollusk fauna and stands out as a model of a regional faunal revision.

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1997. Checklist of the marine bivalves of the northeastern Pacific Ocean. Contributions in Sciences 1. Santa Barbara Museum of Natural History. 28 pp.

Rüdiger Bieler, Department of Zoology, Field Museum of Natural History, Roosevelt Drive at Lake Shore Drive, Chicago, IL 60605, USA

UPCOMING MALACOLOGICAL MEETINGS

American Malacological Society

The American Malacological Society (AMS) will hold its 65th annual meeting in Pittsburgh, PA at the Sheraton Station Square from 4-9 July 1999. Five symposia, a Malacology Curation Workshop for Amateurs, to be organized by Dr. Charles Sturm, and poster sessions are planned. The five symposia are: New Looks at Old Mollusks, Dr. Harold Rollins, convener; Molluscan Genetics: Dr. Laura Adamkewicz, convener; Molluscs and Education: Dr. M. Patricia Morse, convener; Women in Malacology: Dr. Louise Russert-Kraemer, convener and Biomineralization, Dr. Joseph Carter, convener.

Three field trips will be offered, a fossil trip, to be led by Albert Kollar of the Carnegie Museum; a freshwater trip, to be led by Dr. Art Bogan and a visit to the Carnegie Museum of Natural History, Mollusk Collection.

Social events are a Presidential/Symposium Reception, Auction & Art Display and Banquet Cruise aboard the Gateway Clipper.

For further information, contact Dr. Robert S. Prezant, President, AMS, Office of the Dean, Division of Math & Natural Sciences, Queens College, Flushing, NY 11367-1597, USA.

International Workshop of Systematics, Phylogeny and Biology of Opisthobranch Molluscs

A preliminary notice of this International Workshop has been announced. It is to be held in Menfi, Sicily (Italy) from 10-14 June 1999.

For further information contact Dr. Juan Lucas Cervera at: Facultad de Ciencias del Mar, Universidad

de Cadiz, Poligono del Rio San Pedro s/n Apdo. 40, E-11510 Puerto Real, Cadiz, Spain. Information will also be available on the web at the following: <http://www.futuralink.it/vannarotolo> and at <http://www.aicon.com/sim>

IV Congreso Latinoamericano de Malacología (IV CLAMA) y II Encuentro de Investigadores en Malacología de Chile (II EIMCH)

This is the first announcement of this meeting which will be held from 6-10 September 1999 at the Universidad Católica del Norte, Sede Coquimbo, Campus Guayacán, Coquimbo, Chile.

Planned subjects are general malacology, taxonomy, phylogeny, biology, paleontology, genetics, ecology, pathology, physiology, reproduction and development, archaeology, fisheries and culture. Symposia, conferences and oral and panel discussions are planned.

For additional information contact the Committee Organizer: Comité Organizador del IV CLAMA y II EIMCH, Casilla 117, Coquimbo, Chile or Fax: (56) (51) 209812.

Third Annual Gathering of the Southern California Unified Malacologists (SCUM)

The third annual SCUM meeting, an informal gathering of malacologists, will be held on Saturday, 16 January at the Torrey Pines Campus of National University, 11255 North Torrey Pines Rd., La Jolla, in Room 123 at 10 a.m. All persons interested in Recent and/or fossil mollusks are invited. Presentations are informal and a slide projector, overhead projector and internet capabilities will be available. Parking is free.

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THE FESTIVUS

A publication of the San Diego Shell Club

ISSN 0738-9388

Volume: XXXI

February 11, 1999

Number: 3

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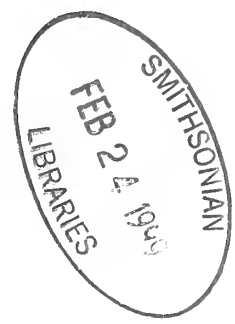
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Address all correspondence to the San Diego Shell Club, Inc.,
c/o 3883 Mt. Blackburn Ave., San Diego, CA 92111, USA.

The Festivus is published monthly except December.
The publication date appears on the masthead above.
Single copies of this issue: \$5.00 plus postage.

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Meeting date: third Thursday, 7:30 PM,
Room 104, Casa Del Prado, Balboa Park, San Diego

PROGRAM

Molluscan Species Diversity in the Eastern Pacific

Kaustov Roy, of the Biology Department at UCSD will speak on species diversity in the eastern Pacific	focusing on physical and biological factors from the Pleistocene to the present that control distribution.
----------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------

Meeting date: 18 February 1999

Shells of the month: Shells found both in the Panamic and Californian provinces

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CLUB NEWS

Minutes of the San Diego Shell Club Meeting - January 21, 1999

President Terry Arnold called the meeting to order at 7:40 p.m. The minutes of the November meeting were approved as published in *The Festivus*. The membership welcomed Mark Scott, a guest.

This year's Auction/Potluck will be on April 24th at the same location (Wes Farmer's condo) as last year. Donations are now being accepted and the sign-up sheet for the potluck will be passed around next month. The September party will be at the Arnold's house, the date to be announced. The Christmas party this year will be at the same place, the Montfield Room of the Sheraton on Aero Drive on Saturday evening, December 4th.

Librarian Margaret Mulliner encouraged members to use the Club's fine library.

Program chairman Mike Mason introduced the speaker for the evening, Hank Chaney of the Santa Barbara Museum of Natural History. He discussed the publications on marine mollusks over the centuries, highlighting the publications with slides of the books and shells. The binomial nomenclature started in the 1700s with Linnaeus. Because of the extensive subject, publications have been approached in one of three ways: comprehensive, regional (including monographs and original literature) and theme-based (i.e. beauty, rarity). Melvin was the first to attach values to the shells. The merits and shortcomings of many publications were discussed. Some of the families such as Cypraeidae are well studied while some families, even larger ones, have been neglected in the literature. Hank mentioned that Scripps library is a very good place to find resources — in addition to our own Club library.

The winner of the drawing was Del Klaus and the refreshments were provided by Carole and Jules Hertz. The meeting was adjourned for refreshments and chitchat on our favorite subject.

Silvana Vollero

Two Shell Collections Donated to the Club

The San Diego Shell Club is the fortunate recipient of two shell collections, the Jim Burbeck Collection and

the Elizabeth Fall Collection (donated by Sally Fall). The Club appreciates these donations, the shells from which will be gradually included in Club auctions to benefit the Club's projects. Also donated by Jim Burbeck was a complete set of the Sally Diana Kaicher cards (see page 24).

Club Calendar of Social Events for 1999

Club Auction/Potluck - Saturday evening April 24th
Fall Party - Saturday evening September ?
Christmas Party - Saturday evening December 4th

Club Appointments and/or Committees for 1999

Parliamentarian - Jules Hertz
Historian - Kay Klaus
Librarian - Margaret Mulliner
Publicity - Bill Romer
COA rep. - Kim Hutsell
Botanical Foundation rep. - Wes Farmer
Telephone - Jules Hertz & *****
Host - *****

As can be seen above, the Club still needs a host and a North County member of the phone committee. If you are willing to help, please contact Terry Arnold at 619-235-8181 or e-mail at tarnold@computer.org

The 1999 Auction/Potluck

The Club's annual Auction/Potluck will be held on Saturday evening April 24th and it is not too early to consider your donation to the auction. Further details and map will be included in the March issue.

The proceeds from the auction fund the Club's activities such as the donations to the Greater San Diego Science Fair, additions to and maintenance of the Club library and support for *The Festivus*.

The auction is only as good as the material donated -- and the people who attend. Please look through your collection and bring your donation to the February or March meetings. If you are unable to attend either meeting, contact a board member and arrange for pickup.

INTELLIGENT PREDATION BY THE CALIFORNIA TWO-SPOT OCTOPUS

ERIN CASEY¹

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The California Two-Spot Octopus, *Octopus bimaculoides* Pickford & MacConnaughey, 1949, makes its habitat in protected holes and crevices in pools in middle and low intertidal zones (Hochberg & Fields, 1980) where it is known to prey upon bivalve mollusks (Llang, 1997). Octopuses use the microscopic teeth on a radula as a drill (Pilson & Taylor, 1961) in conjunction with a salivary papilla that slowly dissolves shell material (Nixon & Maconnachie, 1988) to drill a hole about the size of the tip of a ball-point pen. If the octopus has drilled a hole over and into the adductor muscle, the shellfish may open easily. If the hole has been drilled into a less-critical area of the shellfish, the octopus may have a more difficult time opening the two halves. A small amount of paralyzing toxin also may be injected into the mollusk (Nixon, Maconnachie & Howell, 1980).

Based on casual observation of many hundreds of bivalve shells with boreholes found along the beaches of the Southern California coast, it appeared that, not only did the *Octopus bimaculoides* drill predominantly over or near the adductor muscles of bivalves, but that its drilling was asymmetric, favoring one side over the other, a possible indication of intelligent predatory behavior. It appeared that the octopus had a tendency to make its borehole over the segment of shell anterior of the umbo. The following study was a test to confirm this observation.

Drilled bivalve shells of twelve species were collected over the course of twelve trips to the beach and tide pools at Coal Oil Point and Goleta Beach (Southern California) during the months of January and February 1998. Shells were identified using the guides of Abbott (1991) and Rehder (1995). These beaches

had a continual length of about three kilometers. These areas were known to be some of the main habitats of the *O. bimaculoides* (Hochberg & Fields, 1980). In addition, shellfish with octopus boreholes from the California coast in the collections of the Santa Barbara Museum of Natural History were also studied. The majority of the shells (67%) were *Protothaca staminea* or Common Pacific Littleneck, one of the most abundant bivalves in Central and Southern California waters. In addition to *Protothaca staminea* data were taken on the following species of bivalves possessing an octopus borehole: *Cumingia californica*, *Saxidomus nuttalli*, *Tresus nuttalli*, *Macoma inquinata*, *Macoma nasuta*, *Macoma pacis*, *Rupellaria carditoides*, *Ostrea lurida*, *Compsomyx subdiaphana*, *Pseudochama exogyra* and *Chama arcana*. In all, data were taken on 132 bored shells; about half of the total shells studied were from the collections at the Museum and the other half were the shells collected for this study. Recorded data included the species of the shell, the side of the valve (left or right), and the segment (one of six "pie slices") in which the borehole was made. The location of the borehole was also recorded on a standardized illustration of the shell.

Bivalve shell halves that had been bored by *Octopus bimaculoides* were identified based on the size and shape of the hole. An octopus drills a very small, round, and perfectly cylindrical hole, whereas the marine snail *Bursa californica*, for example (another predator of bivalves), drills a very large (up to ¼-inch in diameter), tapered, and occasionally lopsided hole (Williams, 1976).

A chi-square statistical test was conducted to determine if there was a difference between the

¹ 1998 winner of the Grand Prize (best exhibit in all categories), Santa Barbara County Science Fair; 1998 winner of "Project of the Year" (grand prize in the senior division), California State Science Fair.

percentage of left and right valves. The test showed that the proportion of left and right valves was essentially the same and not statistically different (50.3 percent for left valves and 49.7 percent for right valves, meaning that the sample was based on an equal number of left and right valves ($\chi^2=2.03$; $DF=5$; $p=.83$). Accordingly, all subsequent analyses were combined (for the left and right shells).

The number of shells having a borehole in each of six segments was then examined (see Table 1). There were only nine shells (less than 7% of the total) with a borehole in segment 1 (at the top of the shell; roughly the 11:00 o'clock to the 1:00 o'clock position). Moving clockwise down a left valve or counterclockwise down a right valve to segment 2, there were only seven shells having a borehole in this segment. Similarly, when moving clockwise down a right valve or counterclockwise down a left valve to position 6, there were only four shells (just 3% of the shells) with a borehole in this position. Boreholes in segment 5, which is between 3:00 o'clock and 5:00 o'clock on a right valve and 7:00 o'clock and 9:00 o'clock on a left valve, were exceptionally common. Nearly 57% of all shells studied in this project had boreholes in this position ($N=75$). This finding is shown by bar 5 in Table 1. Note that position 5 is anterior of the umbo and over the adductor muscle, as shown in the combined borehole plot in Figure 1.

Similarly, the segment "opposite" segment 5 is segment 3 (posterior of the umbo). Nearly 17% of the shells ($N=22$) had a borehole in this segment, which is over the posterior adductor muscle. A chi-square test of the distribution of shells across these six categories shows this distribution to be highly significant ($\chi^2=154$; $DF=5$; $p<.0005$). It is clear from Figure 1 that *O. bimaculoides* does not drill a borehole randomly across the surface of a bivalve mollusk, but, rather, over specific areas of the shell, namely, over the areas above the two adductor muscles. Furthermore, the results in Figure 1 show that it is most often the segment over the anterior adductor muscle.

Having found that *Octopus bimaculoides* most often drills its borehole over the anterior adductor muscle of a bivalve shell, a follow-on study was conducted to better understand this behavior. Of the shell halves that were collected, there were 32 shells with boreholes either in segment 3 or in segment 5 (posterior of the umbo and anterior of the umbo). Each of these shells was examined to determine how accurate *O. bimaculoides* had been in its attempt to hit the adductor

muscle. Of the 19 shell halves with boreholes drilled in segment 5 (anterior of the umbo) all 19 attempts hit the adductor muscle. This was determined by looking at the inside of the shell, holding it up to the light, and observing if there was a hole through the adductor muscle scar on that side. Almost every single borehole was in the center of the adductor muscle scar.

Of the 13 shell halves with boreholes drilled in segment 3 (posterior of the umbo), only four of the attempts at hitting the posterior adductor muscle were successful. As shown in Table 2, nine out of the 13 attempts were misses.

These data show that *Octopus bimaculoides* is more accurate when drilling a borehole over the anterior adductor muscle than when it is drilling a borehole over the posterior adductor muscle. The octopus may be more accurate anterior of the umbo by feeling the indent on the inside of the umbo curve and finding the exact spot of the underlying adductor muscle. When *O. bimaculoides* tries to find the area over the posterior adductor muscle (in segment 3), it is less accurate in its attack. It is possible that *O. bimaculoides* has no clue to lead it to the location above the posterior adductor muscle.

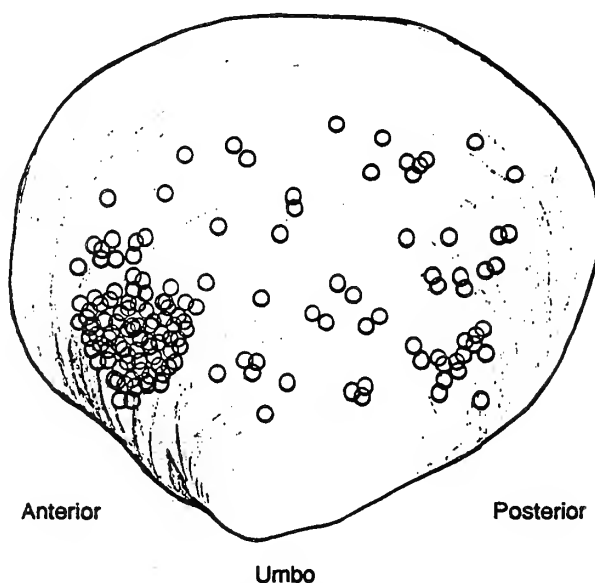


Figure 1. Distribution of boreholes on the sample of 132 shell halves (normalized for left and right halves).

Conclusion

Octopuses are known for their intelligence (Mather & Anderson, 1998), and the fact that *Octopus bimaculoides* tends to make its borehole predominantly

over the anterior adductor muscle may maximize its chances of a successful attack on a bivalve mollusk. Shell drilling location in octopuses may be a sign of learned specialization (Mather & Anderson, 1998) as *O. dofleini* (Wulker, 1912) drills centrally in a bivalve shell (*ibid*) and *O. rubescens* and *O. mimus* also drill over the adductor muscles (Mather & Anderson, 1998; Cortez *et al.*, 1998). In their studies of octopus

predation on gastropods and crabs, Runham *et al.*, 1997, state that "holes appear to be located in specific regions of the shells of their prey and this must be determined by the handling behavior of the octopus, but very little is known of this behavior." The results of the current study add to our understanding of this behavior and show that predatory drilling on bivalve mollusks by *Octopus bimaculoides* is surprisingly sophisticated and focused.

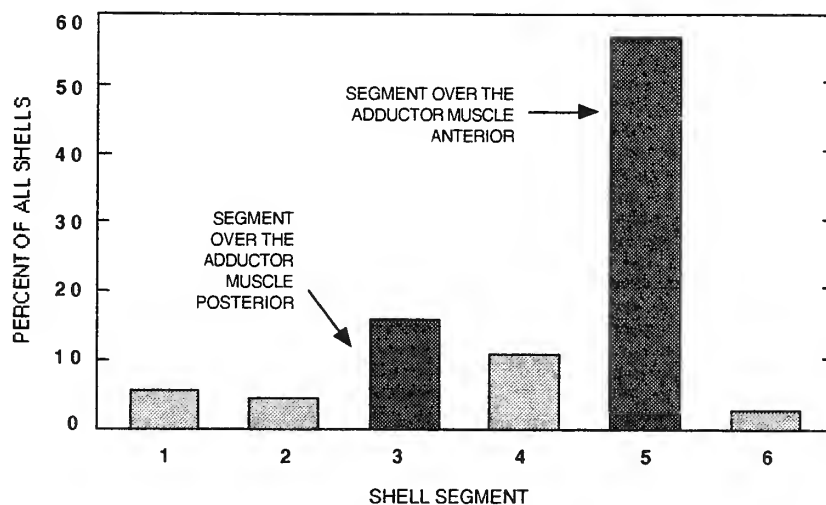


Table 1. Percent of shells with a borehole in each of six segments.

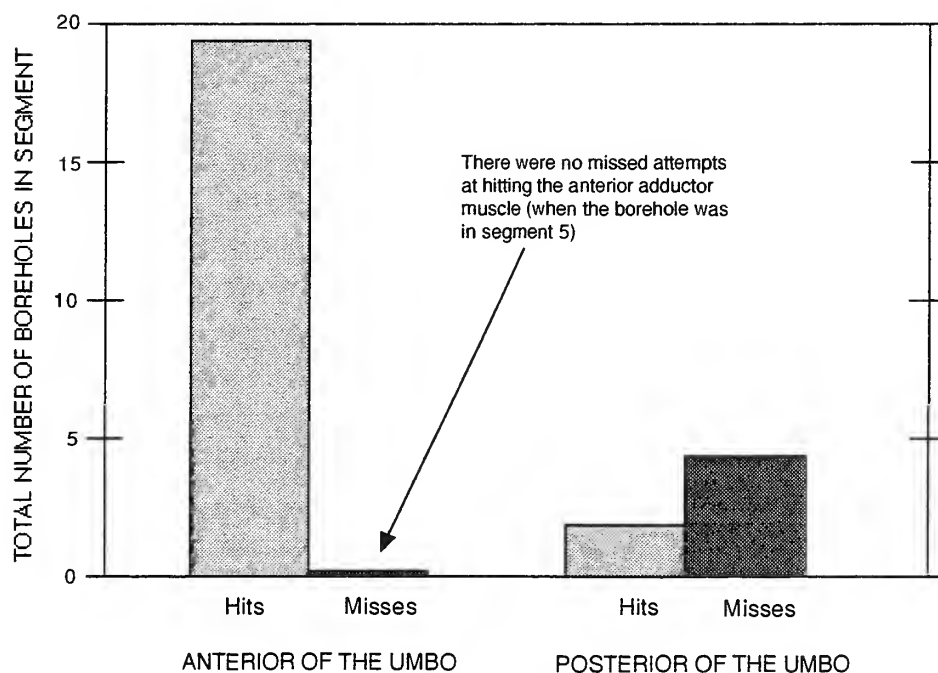


Table 2. Hits and misses of the adductor muscle for boreholes drilled anterior and posterior of the umbo (for segments 5 and 3 only).

ACKNOWLEDGMENTS

The author acknowledges the guidance and assistance of Mr. Paul Scott of the Santa Barbara Museum of Natural History and Mr. Scott Harry of Bishop Garcia Diego High School.

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A COMPLETE SET OF KAICHER'S CARD CATALOGUE OF WORLD-WIDE SHELLS AVAILABLE

A complete set of the Sally Diana Kaicher *Card Catalogue of World-Wide Shells* has been donated to the Club. The Kaicher 3x5" glossy card packs, issued from 1973-1992, cover 26 families. Sixty "packs" were issued with from 97 to 106 cards per "pack" (some families requiring up to 5 "packs"). Each of these handy identification cards has a b&w photograph of one species, often a type or species not previously photographed, with name and author, locality, and brief description of color, size and habitat.

The cards are in mint condition although some of the early "packs" show some slight yellowing on the edges. The ICZN has recently ruled (Opinion 1905) that the Kaicher cards are "not suppressed for nomenclature purposes."

The Club is interested in selling these "packs" as a set with a minimum price of \$500 or best offer above \$500. If interested, contact the Club at the address on the masthead or e-mail: cmhertz@pacbell.net or phone: (619) 277-6259.

REPORT OF A SIX-PLATED *CHITON TUBERCULATUS* LINNAEUS, 1758

GEORGE METZ

121 Wild Horse Valley Drive, Novato, California 94947-3615, USA

The occurrence of anomalous or "freak" shells continue to interest the collector probably because of their uniqueness. Variation in the number of shell plates in the polyplacophorans, is one of these fields of interest. Abnormal plate numbers of polyplacophorans have been carefully studied and catalogued by Dell'Angelo (1982, 1988/1989). His investigation of the literature has accumulated reports of 325 anomalous specimens occurring in seven families of polyplacophorans. Subsequent articles by Baschieri (1994), and Dell'Angelo, et al. (1998) have added to these numbers.

The origin of these abnormalities has been addressed by several authors. Iredale and Hull (1927) described some of the abnormalities as fractures with subsequent fusion on repair, and also stated that "quite a number are clearly of congenital origin." During embryological development, rows of clear epidermal cells, which will secrete the future plates, arise shortly after the trochophore stage. After these divisions first appear, any interference during that stage could result in the loss of a segment with a resultant loss in plate formation. Dell'Angelo and Tursi (1987/1988) summarized the causes of plate number abnormalities, as hypomerism, coalescence and splitting. Hypomerism is described as "The specimens appear to be normal in its general features, therefore, it is possible that this type of anomaly is caused by complete atrophy of one or more vestiges of plates in the developing stage." In coalescence, there is atrophy of an area of a plate with fusion to an adjacent plate. Dell'Angelo adds hypermerism to the above abnormalities, in which there is the addition of a plate, resulting in a nine-plated specimen. Dell'Angelo (1998) has recently reviewed the literature in this particular group and has accumulated twelve such nine-plated specimens in nine different genera. Of the twelve described nine-plated shells, two were found in California and one in Alaska.

This report adds another anomalous chiton to the literature. In 1969, a six-plated *Chiton tuberculatus*

Linnaeus, 1758, was found at Isla Mujeres, Yucatán, México. The chiton was found on the underside of a rock in approximately two feet of water (Figure 1). It measures 61.4 mm in length and is 34.4 mm in width in the dried state. Plates I, II, III and IV appear to be normal while the remaining two plates are unusually

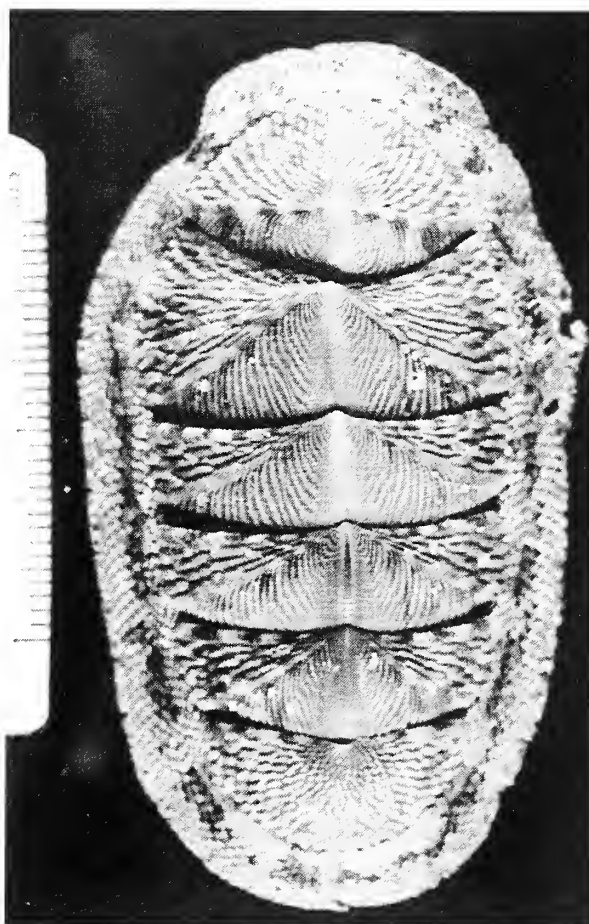


Figure 1. Six-plated specimen of *Chiton tuberculatus* Linnaeus, 1758.

long. Plates V and VI and Plates VII and VIII appear to be fused resulting in a six-plated specimen. This appears to be a case of coalescence. In Dell' Angelo's summary (1987/88), anomalous *Chiton tuberculatus* with seven plates have been reported five times, this is the first report of a six-plated specimen.

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THIRD ANNUAL SCUM MEETING

The third annual meeting of the Southern California Unified Malacologists (SCUM) was held 16 January 1999 in San Diego at the Torrey Pines site of National University. Hans Bertsch hosted the event in a very large and plush meeting room. The meeting began at 10 a.m. and early arrivals enjoyed coffee and muffins while conversing with other attendees. There were 43 people in attendance with attendees from as far away as Avila, California, and Phoenix, Arizona. Attendees each introduced themselves at the start of the meeting and this was followed by informal presentations of 15 minutes or less from each attendee, outlining their recent or current projects and accomplishments. One of the opening highlights was a 15 minute color video presented on a huge television screen. This program entitled "Snails & Slugs" was presented by Alan Grant. It showed many species of nudibranchs and other animals with very interesting sequences of animals feeding, copulating, parasitizing, egg-laying, etc. Other presentations on nudibranchs were presented during the day by Mike Miller on the nudibranchs of Indonesia and by Hans Bertsch on species from the Pacific side of central Baja California. There were many presentations on fossil subjects starting with a description by Nancy Schneider on collecting approximately 200 species of fossil mollusks over a 15 year period from the Mulegé Terrace in Baja California, México. Other fossil presenters were Terry Arnold, Lindsey Groves, George

Kennedy, Scott Ruhe, LouElla Saul, Richard Squires and Carol Stadum. Scott Ruhe presented a map showing several collecting sites in Chula Vista, California, and showed slides of some of the bivalves taken from these sites. LouElla Saul and Carol Stadum discussed the finding of Late Miocene argonaut specimens from the Los Angeles Basin. Doug Eernisse and Jim McLean are both working on revised keys for a new and revised edition of *Light's Manual*. Doug is also working with Klaus Hedegaard on chiton microstructure, while Jim McLean is progressing on his book on all of the gastropods from Alaska to southern California. John Jackson and Chris Meyer discussed activities on a new book on *Zoila* cowries that is being written by Barry Wilson and others in Australia. Chris also presented some slides including cladograms of different groups of cowries based on genetic studies and discussed the diversity of many of the species. Jeff Tupen is working on power plant effects on the shell morphology of *Alia carinata* and he showed some slides of species found near the Diablo Canyon Power Plant in central California. A buffet lunch was available for a donation of \$5 which allowed those attending to meet with others during the lunch break. There were many other presentations and many opportunities for the attendees to discuss mutual interests with others during the breaks and after the meeting. It was a very successful meeting.

Jules Hertz

DESERT ISLAND SNAILS

ROLAND C. ANDERSON

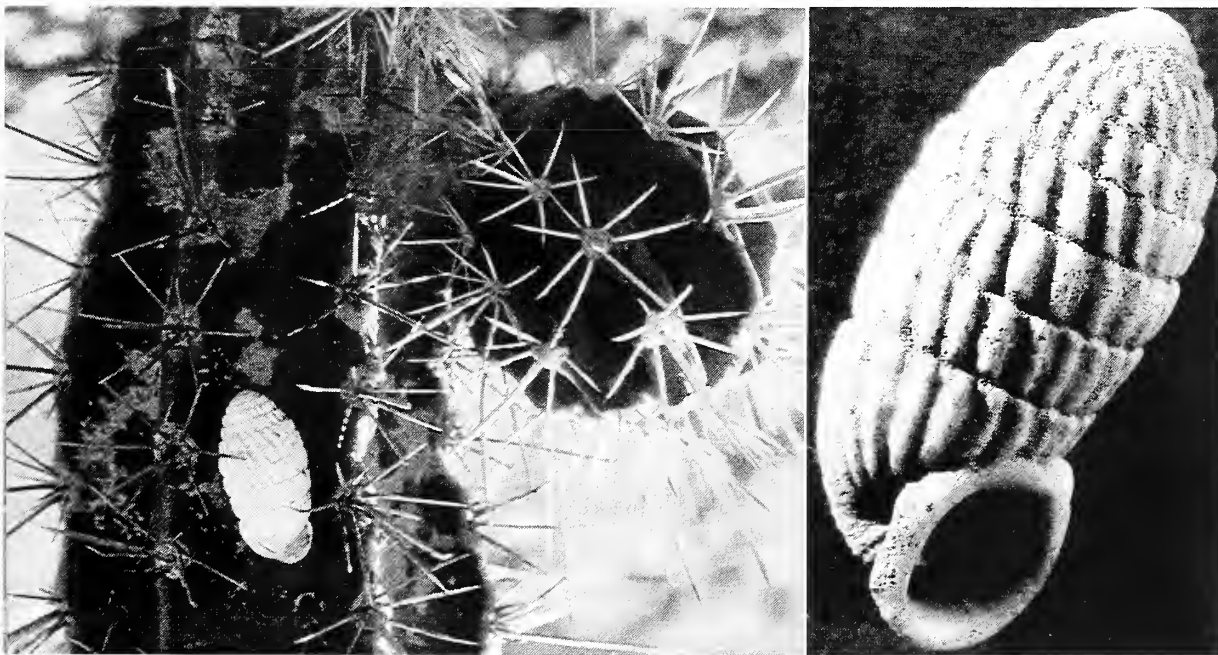
The Seattle Aquarium, 1483 Alaskan Way, Seattle, Washington 98101, USA

When we think of a desert island, we may think of palm trees, grass huts, rain forests, or hula dancers in grass skirts wearing leis. We usually don't think of an island actually being a desert, complete with cactus. Getting only 10-15 inches of rain a year, the island of Bonaire in the southern Caribbean Sea is the other kind of desert, the dry kind, complete with a variety of cactuses. There were 30 foot tall saguaro-like cactus, short round pineapple-shaped cactus, prickly pear cactus, and even a low-lying ground cover cactus. One of our research party remarked on the torture it would be walking on this latter cactus, worse than fire walking.

We were on Bonaire doing a squid research field study, observing the colors and body patterns of the Caribbean reef squid, *Sepioteuthis sepioidea* (Blainville, 1823), but it was hard not to notice other mollusks. We

saw three species of octopuses (*Octopus briareus* Robson, 1929, *O. vulgaris* Cuvier, 1797, and *O. filiosus* Howell, 1868), gaudy nudibranchs (*Tridachia crispata* [Murch, 1863]) and elegant flame scallops (*Ctenoides* [= *Lima*] *floridanus* Olsson & Harbison, 1953) under rocks. On the shore we saw littorinids high above the splash zone, *Nerita* under rocks of the splash zone and two types of chitons nestling in crevices on top of the rocks. Subtidally, we saw *Pinna carnea* Gmelin, 1791, and *Cypraea acicularis* Gmelin, 1791, among others. This was the first *Pinna* I had seen alive and I was much interested in the eccentric bivalve.

One day while touring the island we noticed land snails on the cactus at Washington-Slagbaai National Park. One type was *Cerion uva* (Linnaeus, 1758), noticeable for its restricted terminal whorl, giving it a pupate look (Figures 1, 2). *Cerion* are also noted for



Figures 1, 2. (1) *Cerion uva* (Linnaeus, 1758) crawling on a cactus in Washington-Slagbaai National Park on the island of Bonaire. (2) Closeup of *Cerion uva* (Linnaeus, 1758) showing its unusual constricted terminal whorl. Photos: James B. Wood.

being studied by the eminent paleontologist and evolutionist Stephen Jay Gould (eg. Gould, 1986). *Cerion* are supposed to be located close to the shores of Caribbean islands, and while we found them several miles inland in our cactus garden, we didn't find them at the lookout at 800 feet elevation. In our garden, four on a cement wall in direct sun never moved during the two weeks I was there. I'd like to think they were estivating, perhaps waiting for the rainy winter season. I hope they weren't dead and permanently affixed to the wall by their dried slime. We also found the pink-shelled *Tudora aurantia* (Wood, 1828) (see Baker, 1924) all over the island, including the aforementioned peak (Figure 3). Both were common at the Park, in the rock garden of our rented house in the village of Republik and on the cliff above the shore at the north end of the town of Reykavik. Somehow, it didn't seem "right" to find moist, soft-bodied snails in such an arid climate, and especially on cactus. I guess this shows my bias, rather than being a problem for the snails. They were obviously thriving in the heat, unlike me. I had to retreat periodically into the shade for refreshment with a "tall cool one!"

ACKNOWLEDGMENTS

I wish to thank Dr. Fred Thompson for confirming the identity of the land shells, Mr. James B. Wood for the contribution of his photographs, and Drs. Jennifer and Lynn Mather for inviting me to be part of their research team.



Figure 3. Closeup of *Tudora aurantia* (Wood, 1828). Photo: James B. Wood.

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SUBMISSIONS TO THE *REGISTRY OF WORLD RECORD SIZE SHELLS*

A second issue of the *Registry of World Record Size Shells* is being prepared and the editors are interested in receiving new listings for the *Registry*. Should you have specimens that might qualify for inclusion, i.e. largest for the species (or smallest for some families), measure the specimen in mm with a vernier type calipers (to the nearest 0.1 mm) and get the measurement verified by a second party (professional malacologist, reputable shell dealer or advanced collector). Information required with submission is the species' family, genus, species, author, size, owner or repository, location collected (if known), year collected

(if known), literature reference of identification and signature of verifying party. The editors advise using the form (copies of that form may be made) on the last page of the first issue of the *Registry*. All entries should be sent either to Kim C. Hutsell, 5804 Lauretta St. #2, San Diego, CA 92110-1670, Phone: 619-294-3914, E-mail: khutsell@ix.netcom.com or Don Pisor, 646 North 30th St., San Diego, CA 92102, FAX 619-234-0250, E-mail: d-jpisor@ix.netcom.com. For further information, see the online address <http://www.molluscs.net/Registry/index.html> for the *Registry*. Deadline for entries is May 15th 1999.

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ISSN 0738-9388



THE FESTIVUS

A publication of the San Diego Shell Club

Volume: XXXI

March 11, 1999

Number: 3

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Annual dues are payable to San Diego Shell Club.
Membership (includes family). Domestic \$15.00;
Overseas (surface mail): \$18.00, (air mail): \$30.00;
Mexico/ Canada (surface mail): \$18.00, (air mail): \$20.00.
Address all correspondence to the San Diego Shell Club, Inc.,
c/o 3883 Mt. Blackburn Ave., San Diego, CA 92111, USA.

The *Festivus* is published monthly except December.
The publication date appears on the masthead above.
Single copies of this issue: \$5.00 plus postage.

Website at: <http://www.molluscs.net/SanDiegoShellClub/index.html> Email: cmhertz@pacbell.net

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Room 104, Casa Del Prado, Balboa Park, San Diego

PROGRAM

Traveling, Diving and Photographing in Indonesia and Bali

Mike Miller, award-winning underwater slide program on his trip to Indonesia and Bali last photographer and nudibranch enthusiast, will give a October, highlighting the beautiful marine life there.

Meeting date: 18 March 1999
Shells of the month: shelled opisthobranchs

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CLUB NEWS

Minutes of the San Diego Shell Club Meeting - February 18, 1999

President Terry Arnold called the meeting to order at 7:50 p.m. with about 22 people in attendance. The minutes of the January meeting were approved as published in *The Festivus*. Brad noted one typo in the spelling of "huge." In the April issue of *The Festivus* there will be a map to Wes Farmer's condo where the auction will be held on April 24th. Donations to the auction may be given to any Board member or brought to the March meeting. The sign-up sheet for the potluck was passed around. Each person's dish should be enough to feed 12 people. Librarian Margaret Mulliner mentioned that several years of *The Veliger*, *The Festivus*, the *Hawaiian Shell News* and *The Nautilus* have been bound. The membership welcomed Lorna and Don Guthrie from Seattle.

Program Chairman Mike Mason introduced Kaustov Roy, professor of biology at UCSD. He is interested in live *Strombus* tissue, especially deep-water *Tibia*, for sequencing work. If anyone has specimens to share with him, he is especially interested in distant areas such as the Indo-Pacific.

Roy's discussion was on the geographical distribution of species through two processes - ecological and historical. It is interesting to note that the maximum number of species is in the tropics, which is the same on both coasts of the Americas. The biggest drop in the number of species is at the tip of Baja California. Changes are marked by provincial boundaries. The Californian Province has about 740 living species. Species from cold waters can move to warmer waters, surviving by going into deeper water. Species have changed as a result of climate changes since the Pleistocene when the water was 2° cooler than today.

The winner of the drawing was Don Guthrie, a guest. George Kennedy announced that he had annual reports for the WSM members. The Bradners and the LaGranges brought the delicious refreshments for the evening. The meeting was adjourned to peruse the resources for sale, enjoy the refreshments, and chat about shells.

Silvana Vollero

Too Late for the Roster

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Smithsonian Institution Libraries, Library Acquisitions Acct. #9010520201, Washington, D.C. 20560

The 1999 Auction/Potluck

The Club's annual auction/potluck will be held on Saturday evening April 24th at the community room of Wes Farmer's condo at 3591 Ruffin Rd., San Diego, CA 92123 (map will be in the April issue). Guests are welcome.

The festivities will begin at 5 p.m. with "Dave's Punch," and soft drinks while you view the auction table. Dinner will be at 6 p.m. sharp and the voice auction will begin promptly at 7 p.m.

This is the Club's big fundraiser and the biggest social event of the year. Your help is needed to make it a success. Please either bring your shell donation (with data) to the March meeting or contact Carole Hertz (277-6259) to arrange for pickup.

The annual auction provides the Club with the funds necessary to support its many activities such as *The Festivus*, Club library purchases, donations toward student grants, Greater San Diego Science Fair participation as well as the Club's social functions.

Please look through your collections and help make the auction a success. It's up to you - your attendance and donations make the difference!

An Error in the February Issue

In the February 1999 issue of *The Festivus* [XXXI(2)], the erroneous issue number on the first page is "3," which has already confused two libraries, although the date is listed as February 11. Please correct the number to a "2."

ADDITIONS TO THE 1995 SUMMARY OF MARINE MOLLUSKS OF THE ISLAS REVILLAGIGEDO (TROPICAL EASTERN PACIFIC OCEAN, MÉXICO)

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INTRODUCTION

The Revillagigedo Archipelago is composed of four islands: Socorro, Clarión, San Benedicto and Roca Partida (Figure 1). These are broadly included in a square delimited by 18°20' and 19°20'N and 110°45' to 114°50'W, and represent the only oceanic islands of the tropical eastern Pacific north of Isla del Coco, Costa Rica (6° N). The archipelago has well developed reefs and numerous coral patches inhabited by a rich fauna

and flora (Bautista Romero *et al.*, 1994; León Tejera *et al.*, 1996; Ketchum & Reyes Bonilla, 1997; Reyes Bonilla *et al.*, in press). Brief reviews of the main geomorphological and oceanographic characteristics of the area appeared in Richards & Brattstrom (1959) and Llinas Gutiérrez *et al.* (1993). More recently, excellent data on climatology, sea surface temperatures, geology and hydrography, mineral resources, and marine and terrestrial faunas and floras of Isla Socorro, were

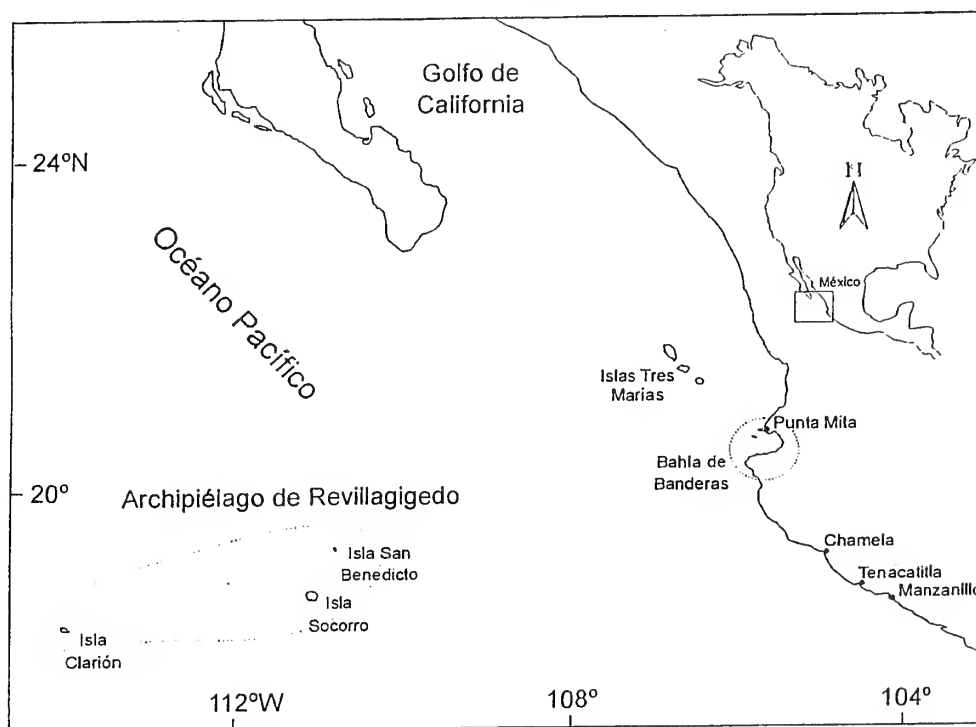


Figure 1. Map of the Archipiélago de Revillagigedo.

presented in a book edited by Ortega Rubio & Castellanos Vera (1994).

The marine environment of the Revillagigedos was much studied in past decades, particularly by U.S. researchers (Richards & Brattstrom, 1959; Brattstrom, 1990), although after the establishment of the Mexican naval stations in Socorro (1957) and Clarión (1979), the number of biological investigations diminished considerably (Llinas Gutiérrez *et al.*, 1993). The last ten years have brought a renewed interest in the marine fauna of the islands, mostly as a concerted effort of the Mexican government, national universities and research centers dedicated to produce the information needed to propose the archipelago as a protected area. In 1994, the four islands and adjacent marine areas were officially declared as a Biosphere Reserve by presidential decree (Castellanos & Ortega Rubio, 1994). Recommended recent references on marine faunas of the Revillagigedos (other than mollusks) include Glynn *et al.* (1996) and Ketchum & Reyes Bonilla (1997) for corals, Garth (1992) for brachyuran crabs, Hernández Aguilera & Martínez Guzmán (1992) for decapods and stomatopods, Solís Marín *et al.* (1993) and Reyes Bonilla (1995) for sea stars and urchins, and Allen & Robertson (1994), the FAO guide (Fischer *et al.*, 1995) and Castro Aguirre & Balart (in press) for fishes. Also, Llinas Gutiérrez *et al.* (1993), Holguín Quiñones (1994), Bautista Romero *et al.* (1994) and Reyes Bonilla *et al.* (in press) present updated species lists of the marine invertebrates of Islas Socorro and Clarión.

Among the best studied groups of the last years in the Revillagigedos are the mollusks; however, the only paper published in English-speaking journals is Dr. W. K. Emerson's (1995) compilation. To date, there are seven papers written by Mexican biologists which include original species lists and observations of gastropods and bivalves from Islas Socorro and Clarión (all of them in Spanish, and published in Mexican professional journals or congress proceedings). Field work was conducted by the Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional, México City (Holguín Quiñones *et al.*, 1992; Holguín Quiñones, 1993, 1994; Mille Pagaza *et al.*, 1994), Universidad de Guadalajara, Guadalajara (Chávez Hernández & Bretado Aguirre, 1990), Universidad Nacional Autónoma de México, México City (Villalobos, 1960) and Secretaría de Marina (González Nakagawa & Sánchez Nava, 1986). Other institutions like Instituto Oceanográfico del Pacífico (Manzanillo), Centro de Investigaciones Biológicas del Noroeste,

Centro Interdisciplinario de Ciencias Marinas, Universidad Autónoma de Baja California Sur (La Paz), and Universidad Autónoma de Guadalajara (Guadalajara) also visited the islands and have small mollusk collections, the contents of which are still unpublished.

The information in these papers is practically unknown and is difficult to consult or obtain outside México. This fact does not diminish its scientific relevance and importance for ecological and biogeographical studies of the mollusk faunas of the eastern Pacific. The main objective of this paper is to present all records of collected species that have been published in Mexican journals that are not included in Emerson's (1995) list of marine mollusks of the Islas Revillagigedo, and to give relevant information on Mexican collections, and where they are currently housed.

The Mexican collections in which these specimens are deposited are:

ENCB - Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional, México, D.F.

UdG - Universidad de Guadalajara, Guadalajara.

SM - Dirección General de Oceanografía Naval, Secretaría de Marina, México, D.F.

ICMyL-UNAM - Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México, México, D.F.

The list of species and new records for particular islands that are not included in Emerson's (1995) review are presented in Tables 1 and 2. They follow almost the same format as that of Emerson, to facilitate comparisons and analysis.

MEXICAN CONTRIBUTIONS TO THE STUDY OF THE MOLLUSK FAUNA OF THE ISLAS REVILLAGIGEDO.

Several papers focused on different aspects of the biology of mollusks from the Revillagigedo Archipelago have appeared in México, by Mexican authors. Here, a brief review of their contents will be presented.

It is important to note that all but one of the seven works has been conducted at Isla Socorro; the exception is the report of González Nakagawa & Sánchez Nava (1986), the only published Mexican field study on mollusks of Isla Clarión. Data for this and two other papers (Villalobos, 1960; Chávez Hernández & Bretado Aguirre, 1990) were generated in one or two visits to the Archipelago by the respective authors, and in them at most three localities were visited.

The rest of the papers encompassed larger time spans (at least two years of seasonal sampling) and dealt with two main aspects: systematic lists of the macromollusks collected at several bays of Isla Socorro, and population biology of *Plicopurpura patula pansa* (Gould, 1853), *Turbo funiculosus* Kiener, 1847, and *Chiton articulatus* Sowerby, 1832. Holguín Quiñones *et al.* (1992), Holguín Quiñones (1993, 1994) and Mille Pagaza *et al.* (1994) presented good species lists complemented with data on collecting sites, community zonation, and relative abundance and occurrence frequency in different seasons of the year. Also, brief descriptions of the general shallow marine landscape are presented; they are important because few papers have accomplished this basic but relevant task. The authors showed that the conspicuous differences among the physiographic characters of the bays and the presence of the naval base may have influenced community structure, as species richness is larger in protected sites and nearby the human settlement (where presumably larger amounts of nutrients enter the sea).

The gastropods *P. pansa* and *T. funiculosus* and the chiton *C. articulatus* have been well studied in México as the first one has been used since pre-Colombian times for dyeing of clothes a bright purple color and in ritual ceremonies (Keen, 1971; Turok *et al.*, 1988), while the others are part of the local diet in many Mexican Pacific cities and ports (Fischer *et al.*, 1995). All three species are abundant at Socorro (Mille Pagaza *et al.*, 1994) and considered as potential resources for eventual commercial exploitation. Holguín Quiñones (1993, 1994) examined their length and weight structure and population density in different sites at Socorro, and indicated that their sizes and abundance are significantly larger than in the mainland, a possible result of the excessive fishing that they suffer there.

ZOOGEOGRAPHIC CONSIDERATIONS.

In this addendum to Emerson's (1995) summary of marine mollusks of the Islas Revillagigedo, 47 species not previously reported are included: 39 gastropods, six bivalves and two chitons (Table 1). With them, the total number of bivalve species known from the islands ascends to 48, while gastropods are now 164, and chitons 10. In the first group, 43 species inhabit the Panamic Province (90% of total), while the remaining taxa are warm temperate Californian species (four) and one cosmopolitan. Of the polyplacophoran species, six (60%) are Panamic, two are Californian, one is Indo-Pacific and one is endemic to the Revillagigedos.

Lastly, gastropods are predominantly Panamic (almost 75%; 122 out of 164), although Californian species (12%) are also common. Circumtropical, Indo-Pacific (5% each) and endemic (3%) are rare. Considering this updated list, the biogeographic affinities of Revillagigedo mollusks do not change much from that described by Emerson (1995), meaning that Panamic species are dominant in the archipelago. In addition to the first list, Table 2 includes the confirmation of the presence of *Barbatia bailyi* (Bartsch, 1931) to the archipelago and five new species records for particular islands (three for Isla Socorro and two for Isla Clarión).

The Islas Revillagigedo (especially Socorro and Clarión) show moderate to high levels of endemism in terrestrial plants and animals (Brattstrom, 1990; Llinas Gutiérrez *et al.*, 1993). However, this characteristic does not seem to be followed by the marine species of the archipelago; for example in the case of mollusks, one out of 10 species of chitons (10%), none of the 48 bivalves, and only five of 164 gastropods (3%) are endemic to the archipelago (Emerson, 1995; Table 1). Bautista Romero *et al.* (1994), León Tejera *et al.* (1996) and Reyes Bonilla *et al.* (in press) mentioned that as a result of their compilations of marine animals and algae known from Islas Socorro and Clarión (more than 700 total taxa), less than 5% of them are endemic to the islands. These findings clearly show that the Islas Revillagigedo can hardly be considered as a biogeographic province by themselves; more precisely, the islands must be taken as a western extension of the Panamic Province (Reyes Bonilla, in prep.).

The difference in percentage of endemism of marine species from the Revillagigedos compared with other oceanic islands of the eastern Pacific like the Galápagos or Clipperton (sites where endemics constitute between 17% and 35% of the total fauna; Glynn *et al.*, 1996; Kaiser, 1997; Wellington, 1997) is remarkable, and it may result from a relative lack of isolation of the Revillagigedo populations from the mainland. As the archipelago is under the influence of the California and Costa Rica currents several months of each year (Bernard *et al.*, 1991), it is feasible that these water masses frequently transport both larvae and adults on floating objects to the island from the nearby American coastline. Moreover, the trip may take less than a month considering average speeds of 0.2 knots around the islands (Lluch Cota *et al.*, 1994). This is time enough to secure survival of many taxa (Scheltema, 1991; Ketchum & Reyes Bonilla, 1997). As support for this idea, in our visits to the archipelago (almost yearly

from 1989 to 1997) it was common to observe large amounts of floating debris like entire *Macrocystis* fronds, coconuts and many kinds of wood in the vicinity of San Benedicto, Socorro and Clarión. On the other hand, if at least for some species immigration to the Revillagigedos was actually interrupted, it is possible that not enough time passed to cause differences between the genetic pools of populations from the island and the continent. Both hypotheses are complementary and deserve to be analyzed in detail with molecular tools.

Emerson (1995) indicated that most mollusks reported from the islands also inhabit mainland localities. All species included in Table 1 do so, except *Colubraria ochsneri* Hertlein & Allison, 1968, which had been found exclusively in the oceanic islands of Clipperton (Keen, 1971), Socorro, the Galápagos (Finet, 1985), Isla del Malpelo (Birkeland et al, 1975), and Isla del Coco (Hertz & Kaiser, 1998). This fact also supports the hypothesis of a lack of isolation between the Revillagigedos and the mainland.

In conclusion, the fairly large number of species that appeared in Mexican publications which were not included in Emerson (1995), shows that we may still be far from establishing a complete species list for the mollusks of the Revillagigedo Archipelago.

ACKNOWLEDGMENTS

Papers from Mexican journals consulted for this review were obtained from the libraries of UABCS (La Paz), Instituto Oceanográfico del Pacífico (Manzanillo), Centro de Investigación Científica y Educación Superior de Ensenada (Ensenada), Instituto de Biología and Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México (ICMyL-NAM, México City), and Centro Interdisciplinario de Ciencias Marinas, Instituto Politécnico Nacional (CICIMAR-IPN, La Paz). William K. Emerson (American Museum of Natural History) and Oscar Holguín (CICIMAR) kindly sent reprints and shared useful information for this work. Three anonymous referees made important comments, additions and suggestions which produced a much better paper, and Oscar Holguín (CICIMAR), Margarita Hermoso and Miguel García (ICMyL-UNAM) reviewed earlier versions of the manuscript.

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Table 1.

Additions to the list of shallow marine mollusks of the Revillagigedo Islands
(Islas de Revillagigedo) since Emerson (1995)

[Classification of Bivalvia follows Bernard, 1983; Bernard *et al.*, 1991; Emerson, 1995. Gastropods follow Keen, 1971; Skoglund, 1992; Emerson, 1995. Polyplacophora follow Skoglund, 1989]. All species occur on the West American mainland, excepting *Colubraria ochsneri* Hertlein & Allison, 1968.

Key: X = New record for the referred island.

Keen No.	Species	Faunal Province	Source of Record and Acronym of Collection where Specimens are Deposited 1=Clarión; 2= Socorro	Isla Clarión	Isla Socorro	Other Tropical Eastern Pacific Oceanic Island Occurrences
BIVALVIA (N=6)						
	MYTILIDAE					
119	<i>Brachidontes adamsianus</i> (Dunker, 1857)	Panamic	² Holguín Quiñones, 1994 (ENCB)		X	Islas Galápagos
138	<i>Lithophaga plumula</i> (Hanley, 1844)	Panamic	² Holguín Quiñones, 1994 (ENCB)		X	L'île Clipperton, Isla del Coco, Islas Galápagos
142	<i>Lithophaga spatiosa</i> (Carpenter, 1857)	Panamic	² Holguín Quiñones, 1994 (ENCB)		X	
	GRYPHAEIDAE					
171	<i>Hyotissa hyotis</i> (Linnaeus, 1758)	Panamic	² Holguín Quiñones, 1994; ² Mille Pagaza <i>et al.</i> , 1994 (ENCB)		X	Islas Galápagos
	CHAMIDAE					
348	<i>Chama frondosa</i> Broderip, 1835	Panamic	² Holguín Quiñones <i>et al.</i> , 1992; ² Mille Pagaza <i>et al.</i> , 1994 (ENCB)		X	Islas Galápagos
351	<i>Chama squamuligera</i> Pilsbry & Lowe, 1932	Panamic	² Holguín Quiñones <i>et al.</i> , 1992 (ENCB)		X	L'île Clipperton, Isla del Coco, Islas Galápagos
GASTROPODA (N = 39)						
	LOTTIIDAE					
45	<i>Lottia acutapex</i> (Berry, 1960)	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	
56	<i>Tectura fascicularis</i> (Menke)	Panamic	² Holguín Quiñones <i>et al.</i> , 1992; ² Holguín Quiñones, 1994 (ENCB)		X	Isla del Coco
---	<i>Lottia limatula</i> (Carpenter, 1864)	Californian	² Poutiers, 1995		X	
52	<i>Lottia strigatella</i> (Carpenter)	Californian	² Holguín Quiñones <i>et al.</i> , 1992; ² Holguín Quiñones, 1994; ² Mille Pagaza <i>et al.</i> , 1994 (ENCB)		X	
	FISSURELLIDAE					
32	<i>Fissurella decemcostata</i> McLean, 1970	Panamic	² Mille Pagaza <i>et al.</i> , 1994 (ENCB)		X	

Keen No.	Species	Faunal Province	Source of Record and Acronym of Collection where Specimens are Deposited 1=Clarión; 2= Socorro	Isla Clarión	Isla Socorro	Other Tropical Eastern Pacific Oceanic Island Occurrences
33	<i>Fissurella deroyae</i> McLean, 1970	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	Islas Galápagos
30	<i>Fissurella morrisoni</i> McLean, 1970	Panamic	² Holguín Quiñones <i>et al.</i> , 1992; ² Holguín Quiñones, 1994; ² Mille Pagaza <i>et al.</i> , 1994 (ENCB)		X	
41	<i>Fissurella spongiosa</i> Carpenter, 1857	Panamic	² Holguín Quiñones <i>et al.</i> , 1992; ² Holguín Quiñones, 1994 (ENCB)		X	
	TURBINIDAE					
144	<i>Turbo fluctuosus</i> Wood, 1828	Panamic	² Villalobos, 1960 (IB-UNAM); ¹ González Nakagawa & Sánchez Nava, 1986 (SM); ² Chávez Hernández & Bretado Aguirre, 1990 (UdG)	X	X	
	VERMETIDAE					
495	<i>Petalonchus complicatus</i> Dall, 1908	Panamic	² Holguín Quiñones <i>et al.</i> , 1992; ² Mille Pagaza <i>et al.</i> , 1994 (ENCB)		X	Isla del Coco, Islas Galápagos
503	<i>Serpulorbis margaritaceus</i> (Chenu, 1844, ex Rousseau MS)	Panamic	² Holguín Quiñones <i>et al.</i> , 1992; ² Mille Pagaza <i>et al.</i> , 1994 (ENCB)		X	Islas Galápagos
	CERITHIIDAE					
507	<i>Cerithium adustum</i> Kiener, 1841	Panamic	² Villalobos, 1960 (IB-UNAM)		X	Isla del Coco, Islas Galápagos
515	<i>Cerithium stercusmuscarum</i> Valenciennes, 1833	Panamic	¹ González Nakagawa & Sánchez Nava, 1986 (SM)	X		Islas Galápagos
	HIPPONICIDAE					
764	<i>Hipponix delicatus</i> Dall, 1908	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	
	VANIKORIDAE					
797	<i>Vanikoro aperta</i> (Carpenter, 1864)	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	
	CAPULIDAE					
832	<i>Capulus sericeus</i> Burch & Burch, 1961	Panamic	² Holguín Quiñones <i>et al.</i> , 1992; ² Holguín Quiñones, 1994; ² Mille Pagaza <i>et al.</i> , 1994 (ENCB)		X	Islas Galápagos
	CASSIDAE					
947	<i>Cypraeacassis coarctata</i> (Sowerby, 1825)	Panamic	² Chan, 1974; ² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	Islas Galápagos
	MURICIDAE					

Keen No.	Species	Faunal Province	Source of Record and Acronym of Collection where Specimens are Deposited 1 = Clarión; 2 = Socorro	Isla Clarión	Isla Socorro	Other Tropical Eastern Pacific Oceanic Island Occurrences
997	<i>Murexiella vittata</i> (Broderip, 1833)	Panamic	² Holguín Quiñones <i>et al.</i> , 1992; ² Holguín Quiñones, 1994; ² Mille Pagaza <i>et al.</i> , 1994 (ENCB)		X	
1087	<i>Plicopurpura columellaris</i> (Lamarck, 1822)	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG); ² Holguín Quiñones <i>et al.</i> , 1992; ² Holguín Quiñones, 1994 (ENCB)		X	Isla del Coco, Islas Galápagos
	CORALLIOPHILIDAE					
1060	<i>Coralliophila macleani</i> Shasky, 1970	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	
	BUCCINIDAE					
1115	<i>Cantharus sanguinolentus</i> (Duclos, 1833)	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	Isla del Coco, Islas Galápagos
970	<i>Colubraria ochsneri</i> Hertlein & Allison, 1968	Insular endemic, Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG); Finet, 1985; Birkeland <i>et al.</i> , 1975; Hertz & Kaiser, 1998a		X	L'île Clipperton, Islas Galápagos, Isla del Coco, Isla del Malpelo
1328	<i>Latirus concentricus</i> (Reeve, 1847)	Panamic	² Villalobos, 1960 (IB-UNAM)		X	Islas Galápagos
	COLUMBELLIDAE					
1156	<i>Columbella haemastoma</i> Sowerby, 1832	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	Islas Galápagos
1231	<i>Mitrella baccata</i> (Gaskoin, 1852)	Panamic	² Holguín Quiñones <i>et al.</i> , 1992; ² Holguín Quiñones, 1994; ² Mille Pagaza <i>et al.</i> , 1994 (ENCB)		X	
	OLIVIDAE					
1364	<i>Oliva porphyria</i> (Linnaeus, 1758)	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	Islas Galápagos
	CONIDAE					
1502	<i>Conus dalli</i> Stearns, 1873	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	Isla del Coco, Islas Galápagos
	TEREBRIDAE					
1536	<i>Terebra formosa</i> Deshayes, 1857	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	
	TURRIDAE					
1826	<i>Pyrgocythara emersoni</i> Shasky, 1971	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	

Keen No.	Species	Faunal Province	Source of Record and Acronym of Collection where Specimens are Deposited 1 = Clarión; 2 = Socorro	Isla Clarión	Isla Socorro	Other Tropical Eastern Pacific Oceanic Island Occurrences
	ARCHITECTONICIDAE					
---	<i>Heliacus planispira</i> Pilsbry & Lowe, 1932	Panamic	² Holguín Quiñones, 1994; ² Mille Pagaza <i>et al.</i> , 1994 (ENCB)		X	Islas Galápagos
	APLYSIIDAE					
2296	<i>Aplysia californica</i> Cooper, 1863	Californian	² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	
	OXYNOIDAE					
2312	<i>Oxynoe panamensis</i> Pilsbry & Olsson, 1943	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	
	CHROMODORIDIDAE					
2332	<i>Chromodoris sedna</i> (Marcus & Marcus, 1967)	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	
	MELAMPIDAE					
2410	<i>Pedipes angulatus</i> C.B. Adams, 1852	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG); ² Mille Pagaza <i>et al.</i> , 1994 (ENCB)		X	
	SIPHONARIIDAE					
2423	<i>Siphonaria palmata</i> Carpenter, 1857	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	
2425	<i>Williamia peltoides</i> (Carpenter, 1864)	Panamic	² Chávez Hernández & Bretado Aguirre, 1990 (UdG)		X	Islas Galápagos
	TRIMUSCULIDAE					
2428	<i>Trimusculus stellatus</i> (Sowerby, 1835)	Panamic	² Mille Pagaza <i>et al.</i> , 1994 (ENCB)		X	
POLYPLACOPHORA (N = 2)						
	ISCHNOCHITONIDAE					
19	<i>Ischnochiton petaloides</i> (Gould, 1846)	Indo-Pacific, Panamic	² Holguín Quiñones, 1994; ² Mille Pagaza <i>et al.</i> , 1994 (ENCB)		X	
	LEPIDOCHITONIDAE					
---	<i>Mopalia muscosa</i> (Gould, 1846)	Californian	² Holguín Quiñones, 1994; ² Mille Pagaza <i>et al.</i> , 1994 (ENCB)		X	

TABLE 2.

Species reported from the Islas Revillagigedo by Emerson (1995) with records for specific islands and confirmation of records previously considered doubtful

[Classification of Bivalvia follows Bernard, 1983; Bernard *et al.*, 1991; Emerson, 1995. Gastropods follow Keen, 1971; Skoglund, 1992; Emerson, 1995.]

Key: X = New record for the referred island.

* = Species cited by Emerson (1995) as inhabitant for the referred island.

+ = Doubtful record in Emerson (1995) which is now confirmed.

Keen No.	Species	Faunal Province	Source of Record and Acronym of Collection where Specimens are Deposited 1=Clarión; 2= Socorro	Isla Clarión	Isla Socorro	Other Tropical Eastern Pacific Oceanic Island Occurrences
BIVALVIA (N=2)						
	ARCIDAE					
70	<i>Barbatia bailyi</i> (Bartsch, 1931)	Californian, Panamic	¹ González Nakagawa & Sánchez Nava, 1986 (SM); ² Holquín Quiñones, 1994 (ENCB)	+	+	Islas Galápagos
	GASTROCHAENIDAE					
694	<i>Gastrochaena ovata</i> Sowerby, 1834	Trans-American	² Holquín Quiñones, 1994 (ENCB); Hertz & Kaiser, 1998b	*	+	L'île Clipperton, Islas Galápagos, Isla del Coco
GASTROPODA (N=4)						
	LOTTIIDAE					
49	<i>Lottia mitella</i> (Menke, 1847)	Panamic	¹ González Nakagawa & Sánchez Nava, 1986 (SM)	X	*	Islas Galápagos
	BURSIDAE					
964	<i>Bursa corrugata corrugata</i> (Perry, 1811)	Panamic	¹ González Nakagawa & Sánchez Nava, 1986 (SM)	X	*	Isla del Coco, Islas Galápagos
	TEREBRIDAE					
1566	<i>Terebra strigata</i> Sowerby, 1825	Panamic	² Chan, 1974	*	X	Isla del Coco, Islas Galápagos
	ARCHITECTONICIDAE					
428	<i>Heliacus bicanaliculatus</i> (Valenciennes, 1832)	Panamic	Mille Pagaza <i>et al.</i> , 1994 (ENCB)	*	X	Islas Galápagos

MAURITIA SCURRA (GMELIN, 1791) (GASTROPODA: CYPRAEIDAE)
ON EGGS AT L'ÎLE CLIPPERTON [FRANCE],
TROPICAL EASTERN PACIFIC

KIRSTIE L. KAISER¹

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Santa Barbara, California 93105, USA
E-mail: j2k2@compuserve.com

While diving off the Smithsonian Institution's *R/V Urracá* from 21 April to 5 May, 1998, at L'île Clipperton [France] (10°17.75'N, 109°13.90'W), I collected two live specimens and one freshly dead specimen of *Mauritia scurra* (Gmelin, 1791). One of the live specimens was found on an egg mass at a depth of 18 m (60 ft) on the underside of a piece of dead coral (Figures 1-3). This is the first report of a live specimen from L'île Clipperton [France]. The largest specimen has a length of 60.9 mm and a width of 32.5 mm, a world record. Hutsell, Hutsell & Pisor (1997) show the previous record for *M. scurra* as 57.2 mm, a shell from Midway Island.

Beals (1995) described the collecting of *Cypraea* on the Clipperton '94 Expedition. He reported that although Emerson (1994) stated that 11 species of *Cypraea* had previously been reported from L'île Clipperton [France], the '94 Clipperton Expedition found only six species: *albuginosa*, *alisonae*, *isabellamexicana*, *helvola*, *moneta* and *scurra*. Only dead shells of *scurra* were found, mostly in beach drift of coral rubble plus two specimens at 11-17 m (35-50 ft). He commented that most of the *M. scurra* collected at Clipperton were large in size, the biggest being 59.7 mm, an apparent record at the time.

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1995. Cowries of Clipperton. *World Shells* 14: 73-76, 5 figs. (Sept.)

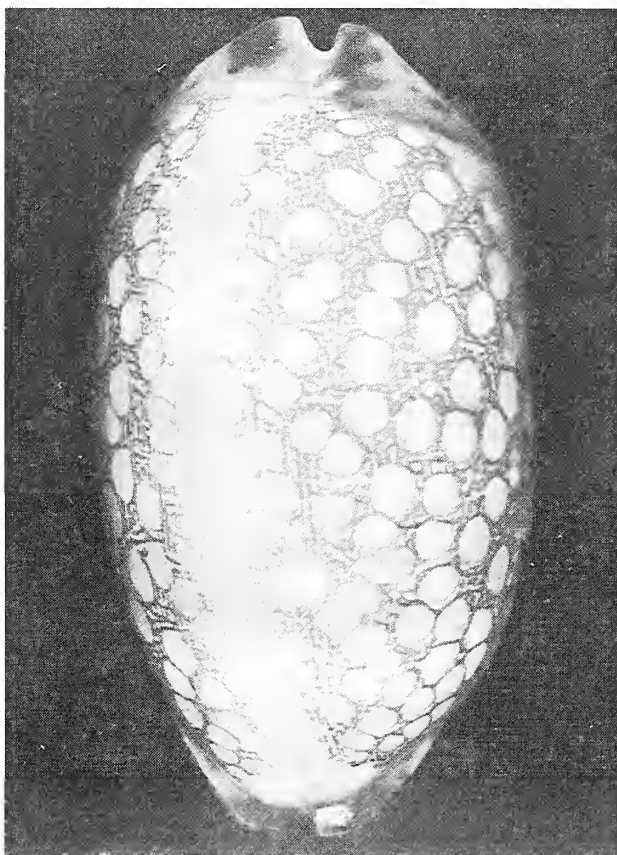


Figure 1. *Mauritia scurra* (Gmelin, 1791), found live on eggs under dead coral heads in 18 m (60 ft) at L'île Clipperton, 21 April-5 May 1998, Leg. K. L. Kaiser. Photo: D. K. Mulliner.

¹ Mailing address: Mail Boxes, Etc., Suite 078-444, 9051-C Siempre Viva Road, San Diego, CA 92173-3628, USA.

EMERSON, WILLIAM K.

1994. A zoogeographic summary of the marine mollusks of Clipperton Island (tropical eastern Pacific Ocean). The Festivus 26(6): 62-71, 1 fig. (June)



HUTSELL, KIM C., LINDA L. HUTSELL & DONALD L. PISOR

1997. Registry of World Record Shells, Snail's Pace Productions, San Diego, California, USA. Pp. i-ii and 1-101. (June)



Figures 2, 3. (2) Egg mass of specimen shown in Figure 1. (3) Closeup of egg mass shown in Figure 2. Photos: D. K. Mulliner.

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THE FESTIVUS

A publication of the San Diego Shell Club

ISSN 0738-9388

Volume: XXXI

April 8, 1999

Number: 4

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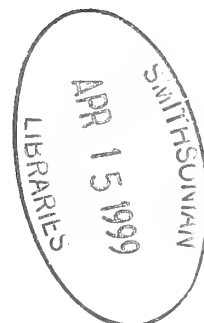
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Membership (includes family). Domestic \$15.00;
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Address all correspondence to the San Diego Shell Club, Inc.,
c/o 3883 Mt. Blackburn Ave., San Diego, CA 92111, USA.

The *Festivus* is published monthly except December.
The publication date appears on the masthead above.
Single copies of this issue: \$5.00 plus postage.

Website at: <http://www.molluscs.net/SanDiegoShellClub/index.html> Email: cmhertz@pacbell.net

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Meeting date: third Thursday, 7:30 PM,
Room 104, Casa Del Prado, Balboa Park, San Diego

PROGRAM

THE ANNUAL AUCTION/POTLUCK

Come to the annual auction/potluck on Saturday evening, April 24th.
Festivities begin at 5 PM. For details, see Page 44 and map on last page.
There will be no regular meeting this month.

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CLUB NEWS

Minutes of the San Diego Shell Club Meeting - March 18, 1999

President Terry Arnold called the meeting to order at 7:45 p.m. The minutes of the February meeting were approved as published in *The Festivus*. The auction on April 24th will be at the clubhouse of Wes Farmer's condo. Donations to the auction may be given to any Board member. The sign-up sheet for the potluck was passed around. Kim mentioned some of the choice specimens that will be available.

A host is still needed. No one present volunteered for the position. Librarian Margaret Mulliner announced that the Club has purchased two new books - one on Ranellidae and one on South African species [see page 51]. They will be available at the May meeting.

Vice President Mike Mason introduced the speaker for the evening. Mike Miller, an underwater photographer, talked about his trip in October 1998 to Bali, Indonesia. He showed some wonderful pictures of very pretty opisthobranchs. His trip was planned during a good time of year for diving when there are low winds, good tides, and low wave activity. One of the pictures showed a native girl carrying over 60 lb. of dive gear on her head. Mike commented that they do this with ease but he also noted that they don't often smile. Some of the species he photographed were recently described. Mike also mentioned that because of the conditions there, you may find the same animals in the same area a day later.

Silvana introduced a guest, Keith Allen. The winner of the drawing was Linda Hutsell. The meeting was adjourned with a motion by Kim Hutsell at 8:30 p.m. Then everyone socialized and enjoyed the refreshments from Bob and Silvana.

Silvana Vollero

The 1999 Auction/Potluck

Have we got shells for you!!!

Among some of the very special items for auction are a deepwater vent gastropod, a monster-sized *Lambis crocata pilsbryi*, *Voluta bednalli*, *Ceratostoma burnetti* and a *Cypraea alisonae* from Clipperton. Other equally fantastic offerings include books and shell related

articles, a \$1, \$2, \$3 table and silent auction.

Come to the auction/potluck on Saturday evening April 24th in the community room of Wes Farmer's condo at 3591 Ruffin Rd., San Diego, CA 92123. See map on last page. Guests are welcome.

The festivities will begin at 5 p.m. with "Dave's Punch" and soft drinks while you view the auction table. Dinner will be at 6 p.m. sharp and the voice auction will begin promptly at 7 p.m.

This is the Club's big fundraiser and the biggest social event of the year. Your help is needed to make it a success.

The annual auction provides the Club with the funds necessary to support its many activities such as *The Festivus*, Club library purchases, donations toward student grants, Greater San Diego Science Fair participation as well as the Club's social functions.

It's still not too late to donate, so please look through your collections and help make the auction a success. Contact Carole Hertz (277-6259) to arrange for pickup. It's up to you - your attendance and donations make the difference!

Too Late for the Roster

Auckland Institute & Museum, Serials Librarian, Private Bag 92018, Auckland, New Zealand
Clover, Phillip W., P.O. Box 339, Glen Ellen, CA 95442, phone/FAX (707) 996-6960
Roberts, Dale L. & Kimberly, 28402 Harvest View Lane, Trabuco Canyon, CA 92679, (714) 459-0928, FAX (714) 888-2786

Club Host Still Needed

The Club still needs a host to set up the refreshment table at meetings. It's not a difficult job, but it certainly makes the meetings more enjoyable when refreshments are available at the end of the program. If you are willing to help, please contact Terry Arnold at 619-235-8181.

Linda LaGrange has graciously volunteered to be a part of the Telephone Committee, calling North County members, for which we thank her.

AN OCTOPUS BITE AND ITS TREATMENT

ROLAND C. ANDERSON

The Seattle Aquarium, 1483 Alaskan Way
Seattle, WA 98102, USA

On May 12, 1998, a Seattle Aquarium employee was leading a beach walk at Saltwater State Park (20 miles south of Seattle on Puget Sound, Washington State, USA). Several nearby SCUBA divers had caught a red octopus (*Octopus rubescens* Berry, 1953) and brought it to shore to give to the Aquarium (Figure 1). The octopus was placed in a bucket to show the class. As the octopus was being handled by the Aquarium employee using a gloved hand, it abruptly swam to his ungloved hand and bit the employee. The bite was located on the back of his hand above the wrist bone of his ring finger. The bite was not noticed at first, as there was no immediate pain from it.

About a minute later, the employee noticed blood and confirmed the presence of a small puncture wound at the site of the bite. The small puncture wound (less than 5 mm) was consistent with the bite from the beak of the small octopus (24.5 g, 3.4 cm mantle length, corresponding to an arm span of about 10 cm). When he noticed the bite, he sucked on the wound site to extract the venom, but this is not likely to have done much good, particularly in light of the further symptoms. After about ten minutes localized pain was noticed at the wound site. When swelling and "fiery" pain began running up the back of his hand and wrist to his mid-forearm, the employee called the Aquarium on his cellular phone.

Other Aquarium employees suggested immersing the wound in hot water, as hot as the employee could stand. A nearby espresso stand (only in Seattle!) supplied the hot water. The lapsed time was about 20 minutes between the bite and the first aid



Figure 1. A Pacific red octopus (*Octopus rubescens* Berry, 1953) sitting in a moon snail shell. Although some may grow larger, a typical-sized animal weighs about 50 g with an armspan of 30 cm. Photo: Roland Anderson.

treatment. The employee poured the hot water directly over the wound and the adjacent affected area. The pain and swelling dissipated within a minute. The employee then went to Harborview Hospital in Seattle, the area's main trauma care center. Interestingly, the hospital called the Aquarium to get advice on the treatment. The hospital then applied an ointment for the blisters around the bite site caused by the hot water.

The next day the bite could scarcely be seen or felt. There were several residual blisters on the skin from the hot water, which persisted for about a week. Although there was no localized evidence left from the bite, the victim reported headaches and weakness for a week following the bite. In contrast, in the case of an untreated *O. rubescens* bite on an Aquarium employee 20 years earlier, necrosis at the bite site continued for about a month (Plate 1, Figure 1).

Octopus rubescens is known for its potent bites (Halstead, 1949; Berry & Halstead, 1954; Oglesby, 1972; Anderson, 1987; Halstead, 1988; Hochberg, 1997). The bite of an octopus is produced by its beak-like jaws located in the mouth at the center of the arms. In *O.*

rubescens, as in other octopuses, at the time of the bite, the animals inject a proteolytic enzyme or venom via the salivary proboscis (Ballering *et al.*, 1972). Although the bite of other cephalopods, such as octopuses in the genus *Haplochlana*, are known to be fatal (Halstead, 1988), there is relatively little written on the treatment of octopus bites. Hot water is suggested as immediate first aid treatment for the bites and puncture wounds of octopuses (*ibid*) and other marine creatures such as lionfish or stonefish (Thomas & Scott, 1997). In the instance recounted above, immediate hot water treatment was effective in neutralizing the localized effects of the bite of *O. rubescens*. However, as evidenced by the employee's systemic symptoms in the days following the bite, such treatment may not be totally effective. We also don't know if this treatment will prove effective in reducing the trauma from the bites of other octopus species, but it may be a place to start until we learn otherwise.

My thanks go to Ben Brown for sharing his experience with me and to an anonymous reviewer for greatly improving the manuscript.

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UPCOMING MALACOLOGICAL MEETINGS

The Ninth International Zebra Mussel & Aquatic Nuisance Species Conference (ANS)

The conference will be held from 26-30 April 1999 in Duluth MN. This is considered the most comprehensive forum for experts to present results concerning impacts of marine and freshwater aquatic nuisance species.

The conference will be at the Duluth Entertainment Convention Center. For further information, contact the conference Web site at www.zebraconf.org or contact conference administrator, Elizabeth Muckle-Jeffs at 800-868-8776 or e-mail: profedge@renc.igs.net

The Eighth Latin American Congress of Marine Sciences (COLACMAR) and the Cephalopod International Advisory Council (CIAC)

The Congress will be held at the Universidad Nacional de Trujillo in Trujillo, Perú from 17-21 October 1999. The Congress announces a special

symposium on Pacific Jumbo Squids during which the English language will be encouraged for the presentations. For further information, contact Ms Carmen Yamashiro at Instituto del Mar del Perú, PO Box 22, Callao, 1, Perú. or e-mail: cyamashiro@imarpe.gob.pe Also visit the COLACMAR home page: <http://www.imarpe.gob.pe>

The 16th Brazilian Malacological Meeting

The meeting will take place in Recife, Pernambuco, Brazil from 12-16 July 1999 at the Hotel Recife palace Lucsim. The meeting is organized by the Brazilian Malacological Society and is open to all including non-members. For deadline dates, registration fees and further information, contact XV EBRAM, Auxiliary Secretary, General Americano Freire, 394, sl. 403, Boa Viagem, 51021-120 Recife, PE, Brazil. Additional information is available at the web homepage: <http://www.sbma.com.br>

PTERYNOTUS (PURPURELLUS) MACLEANI OR *P. (P.) PINNIGER*
(DREDGED IN THE GOLFO DE CALIFORNIA, MÉXICO)

MARGARET MULLINER

5283 Vickie Drive, San Diego, California 92109, USA
E-mail: mulliner1@juno.com

In May 1997, my husband Dave and I were again dredging in Bahía de los Angeles in the Golfo de California when we found the beautiful muricid figured on Plate 1, figures 2, 3, alive in 50-55 m, in rubble. Is the specimen *Pterynotus (Purpurellus) macleani* (Emerson & D'Attilio, 1969) or *P. (P.) pinniger* (Broderip, 1833)?

Emerson & D'Attilio (1969) described *Pterynotus (Purpurellus) macleani* based on two specimens: the 29.0 mm holotype from the Loreto Channel, Baja California, México, in 46 m (25 fm), and the 22.4 mm paratype from off Islas Secas, Panamá, in 22 m (12 fm). The holotype was figured by Emerson & D'Attilio (1969, pl. 26, figs. 1, 2) and Fair (1976, pl. 15, fig. 190). Keen (1971) and Radwin & D'Attilio (1974) reported the distribution of the species from off Isla Carman, Golfo de California to Panamá. It has also been reported from Isla Danzante where it was collected and lost in 1991 by Jeremy Hutsell (Buck, 1991). Richard McClincy of Tucson, Arizona, found a specimen at Bahía San Carlos, Sonora, México (McClincy in L. Higa, 1984; McClincy, 1991). Fair (1976) extended the distribution to Perú. Emerson & D'Attilio described the species as "similar to *Pterynotus (Purpurellus) pinniger*, but the shell has a much stouter appearance." The specimen we found resembles the specimens of *P. (P.) pinniger* figured by Emerson & D'Attilio (1969: pl. 26, figs. 5-7). In recent years, McClincy (1984, 1991) and Buck (1991) figured specimens as *P. (P.) macleani* which look more like the specimens figured by Emerson & D'Attilio as *P. (P.) pinniger* than the type specimens of *P. (P.) macleani*. McClincy's specimen (1991: 45, fig. 1) shown here in Figure 1 is very similar to my specimen. McClincy stated that he "contacted both Anthony D'Attilio and William Emerson about the specimen [Figure 1] and sent each a set of photographs, measurements and collecting data. Both responded that my specimen

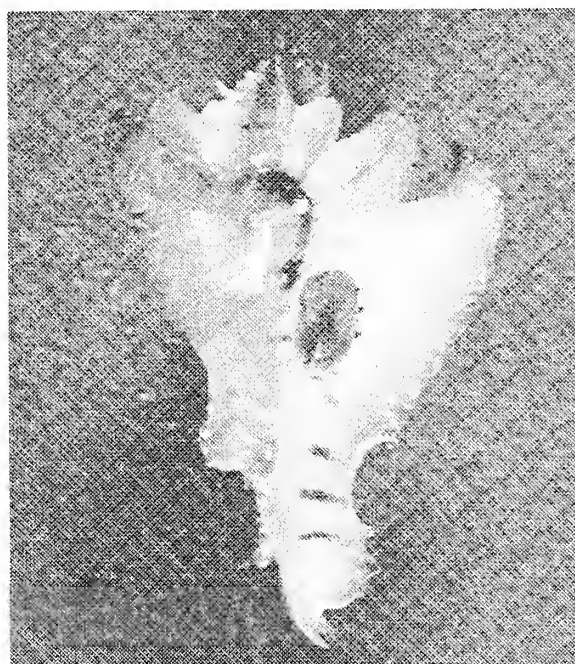


Figure 1. *Pterynotus (Purpurellus) macleani*, a 31 mm specimen from Bahía San Carlos, Sonora, México in 20 m, collected by R. J. McClincy. Photo: R.J. McClincy.

appeared to them, from the photos to be *P. (P.) macleani*. Neither had seen the actual specimen which measures 37 mm long." McClincy also said, "I still have my doubts about the existence of two separate taxa, especially since the soft parts are identical in appearance." McClincy was referring to the animal of the specimen in the photo reviewed by D'Attilio and Emerson compared to animals in specimens of *P. (P.) pinniger* he had previously found.

Although I too have questioned the existence of two separate taxa, I have identified my shell as *Pterynotus (Purpurellus) macleani*. If this is correct, it would extend the distribution north to Bahía de los

Angeles, and the 55.8 mm specimen would also be a new size record. If it were shown in the future that there is only one highly variable species, than the name would be *Pterynotus (Purpurellus) pinniger*. The locality and size of my specimen would then fall within the known distribution and size of *P. (P.) pinniger*.

My thanks to Kim Hutsell for verifying the measurement of my specimen and to my husband Dave for photographing it.

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SEMIPALLIUM MARYBELLAE (RAINES, 1996)

NEW RANGE EXTENSIONS

KIM C. HUTSELL

5804 Laurretta Street #2, San Diego, California 92110-1670, USA

E-mail: khutsell@ix.netcom.com

The geographic distribution of commercially important species in the family Pectinidae have been well documented for decades. The same is true for some of the more popular non-commercial species. However, the exact ranges for approximately half of the pectinids are still unknown. This is especially true of new and recently named species.

When the new species, *Semipallium marybellae* Raines, 1996, was described, it was known from only two locations on the island of Guam; Asan Point and Luminao Reef. Additionally, it had only been collected at depths of 20 to 30 meters. As this species began to gain recognition and began appearing on the commercial market, new depth ranges were discovered.

One specimen (Plate 1, figure 4) sent to me for identification was collected by Charles Thomas at Glass Breakwater at Apra Harbor, Guam, in May of 1998.

It was taken at a depth of only nine meters, eleven meters shallower than previously recorded. A second specimen of *S. marybellae* (Plate 1, figure 5), now in the collection of Mariah Lawson, was collected by Fred Schroeder at Coco Island, approximately six miles off the southern tip of Guam. This new location extends the geographic range approximately 17 miles southward. Both of these specimens establish short, but significant changes in distribution for *S. marybellae*.

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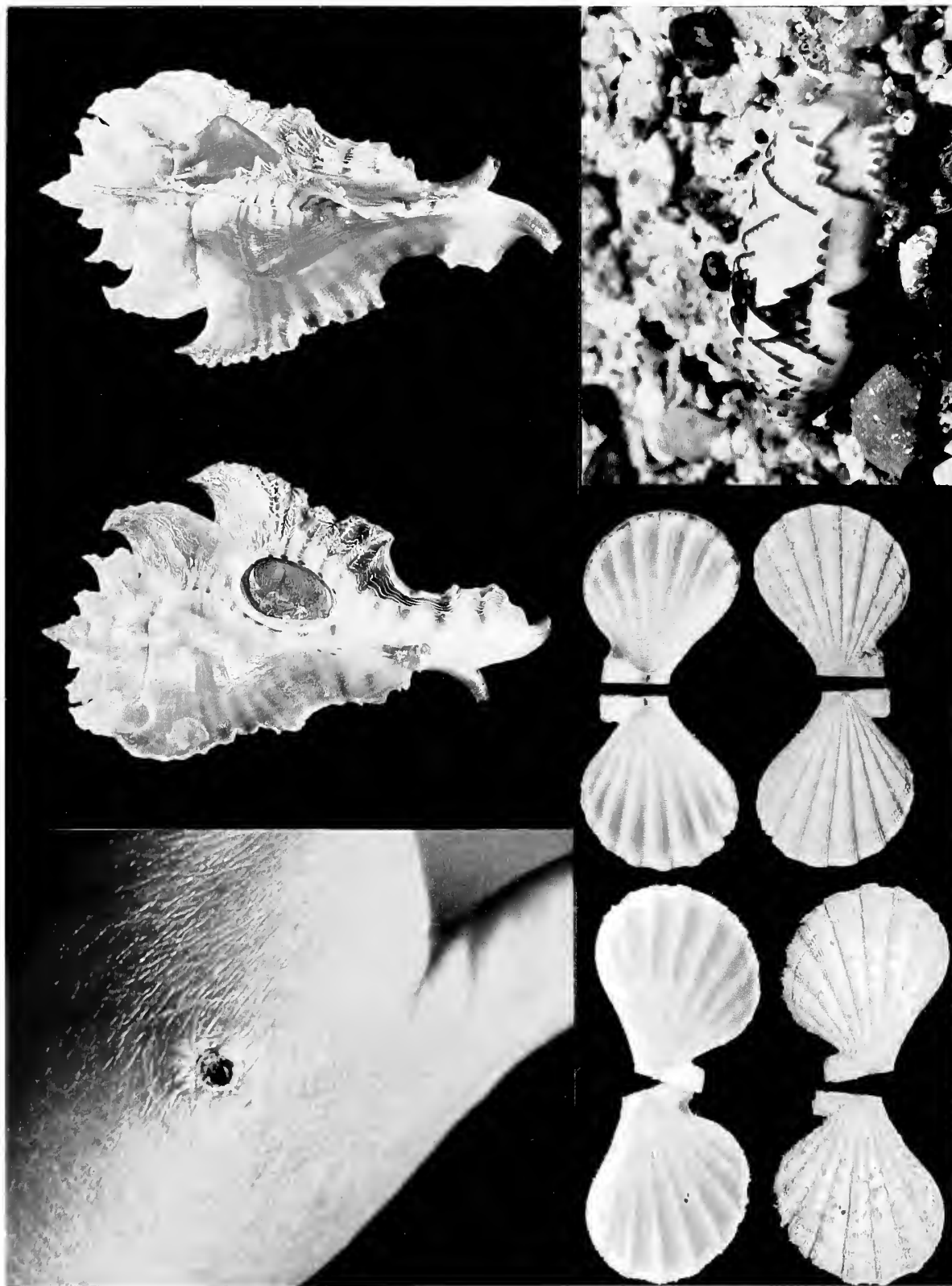


Plate 1: Figure 1. An untreated *O. rubescens* bite produced a necrotic wound on the back of a Seattle Aquarium employee's hand. After 20 years she still bears a 1 cm scar from the bite. Photo: L. Shaw, The Seattle Aquarium. Figures 2, 3. *Hexaplex (Purpurellus) macleani*, apertural and dorsal views of a 55.8 mm specimen from Bahía de los Angeles. Photos: D. K. Mulliner. Figures 4, 5. *Semipallium marybellae*, interior and exterior views (4) Thomas' 45.9 mm specimen, (5) Lawson's 53 mm specimen. Figure 6. *Oliva foxi* crawling in 11 m off Isla Montuosa, Panamá. Photo: C. Bryce.

OLIVA FOXI (GASTROPODA: OLIVIDAE) AT ISLA MONTUOSA, GOLFO DE CHIRIQUÍ, PANAMÁ

KIRSTIE L. KAISER¹

Santa Barbara Museum of Natural History,
2559 Puesta del Sol Road, Santa Barbara, California 93105, USA
E-mail: J2K2@compuserve.com

During the Smithsonian Institution's Expedition to the Golfo de Chiriquí, Panamá, from 5 - 20 December 1998, Clay Bryce of the Western Australian Museum and I were diving off Isla Montuosa (7°28.60'N, 82°13.80'W). On 7 December, we found and photographed a living specimen of *Oliva foxi* Stingley, 1984, at a depth of 11 m, on a sand and rubble substrate among patches of the coral *Porites lobata*. The 34.2 mm specimen of *O. foxi* shown in Plate 1, figure 6 has a cream to pinkish colored base with reddish brown to dark brown zig-zag lines and flag markings. The interior of the shell is tinged with yellow and the base has a blush of lavender. The animal is yellowish cream, mottled with brown markings.

Stingley (1984) described the species from Isla del Coco, Costa Rica, and Shasky (1984) re-described it and reported finding 21 specimens at Isla del Coco. Until now, *Oliva foxi* was considered endemic to Isla del Coco, Costa Rica. The occurrence of the species at Isla Montuosa, Panamá, constitutes a significant range extension to the mainland of Panamá.

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¹ Mailing address: Mail Boxes Etc., Suite 078-444, 9051 Siempre Viva Rd., San Diego, CA, 92173-3628, USA

TWO NEW BOOKS FOR THE CLUB LIBRARY

Two fine new books have been purchased for the Club's library. They will be available for circulation at the May Club meeting (no regular meeting in April) and will be reviewed in a future issue of *The Festivus*.

Marine Shells of South Africa

By: Douw G. Steyn and Markus Lussi. 1998.
Publisher: Ekogilde Publishers, Hartebeespoort.
264 pages, 1006 color figures, over 1000 species covered, hardbound with dust jacket
Price: \$80 US

Indo-West Pacific Ranellidae, Bursidae and Personidae (Mollusca: Gastropoda) A Monograph of the New Caledonian Fauna and Revisions of Related Taxa

By: Alan G. Beu. 1998.

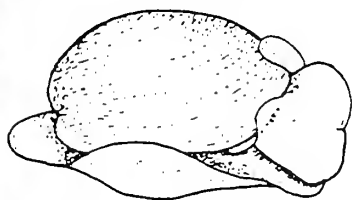
Mémoires du Muséum National d'Histoire Naturelle, Paris, vol. 178. Résultats des Campagnes MUSORSTROM

255 pp., 70 figures, 4 color plates, hardbound with laminated cover
Price: \$78 US

SAN DIEGO SHELL CLUB

AUCTION/POTLUCK

APRIL 24, 1999



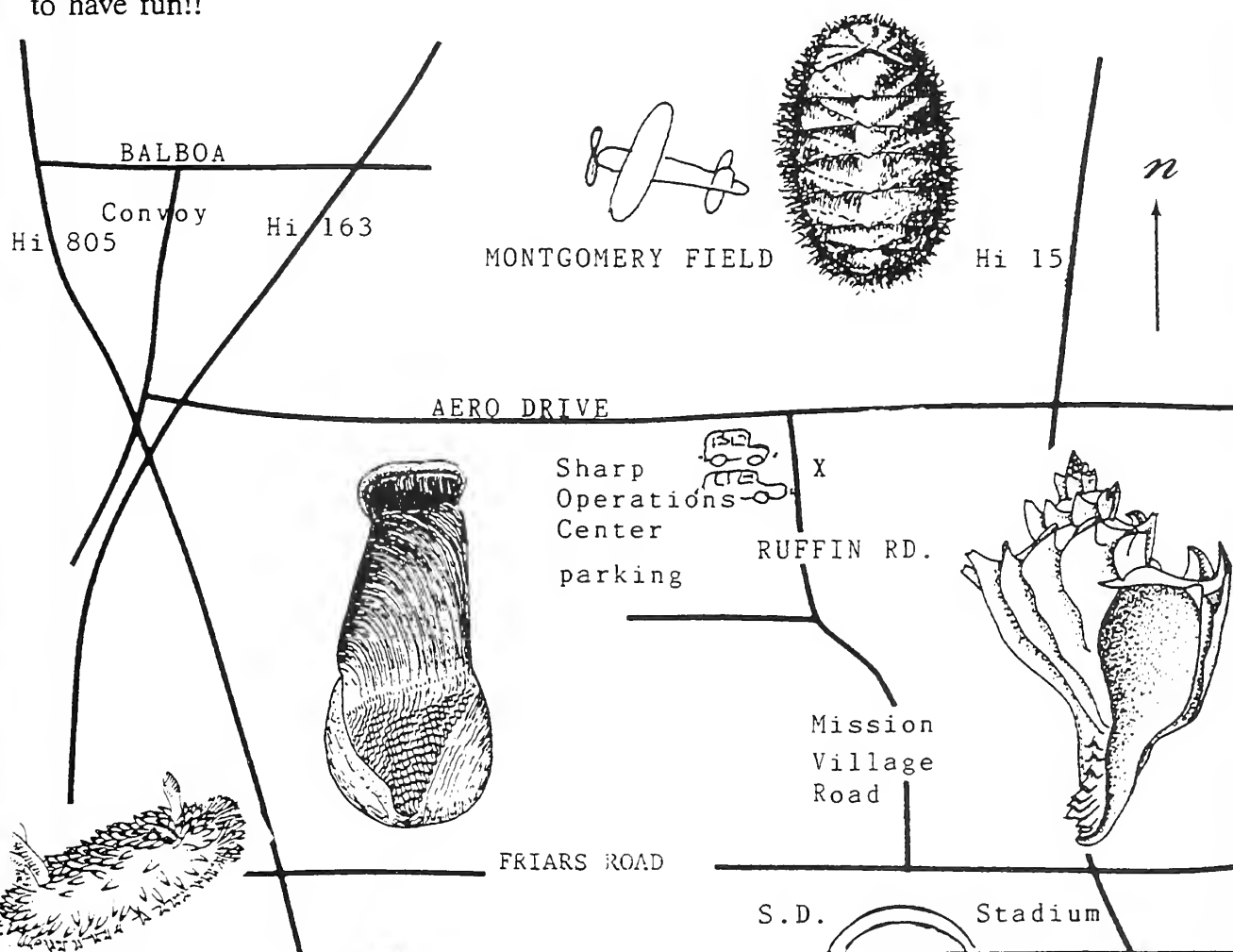
DIRECTIONS TO THE AUCTION: from 805: exit onto Balboa, east to Convoy, south to Aero Dr., east to Ruffin Rd., south about a block or two. Clubhouse on East side of street; park at Sharp Operations Center on West side.

From San Diego Stadium on Friars Road: up Mission Village Drive to Ruffin Rd., right turn or north about a half mile, parking on the west side of the street at Sharp Operations Center across from the Clubhouse.

THE ADDRESS: 3575 Ruffin Rd. at the Summer Hill Clubhouse.

TIME: 5:00 p.m. - ??

REMEMBER TO BRING: Your potluck dish with serving utensils. Also, please bring eating utensils for yourself (plates, cups and napkins will be provided). And come ready to have fun!!

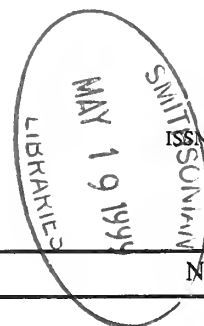


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THE FESTIVUS

A publication of the San Diego Shell Club



ISSN 0738-9388

Volume: XXXI

May 13, 1999

Number: 5

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Annual dues are payable to San Diego Shell Club.
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c/o 3883 Mt. Blackburn Ave., San Diego, CA 92111, USA.

The *Festivus* is published monthly except December.
The publication date appears on the masthead above.
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Meeting date: third Thursday, 7:30 PM,
Room 104, Casa Del Prado, Balboa Park, San Diego

PROGRAM

A Discussion of Common Problems and Practical Solutions
in the Identification of Shells and the Care and Maintenance of Shell Collections

Carol Skoglund, Club member from Phoenix, AZ and author of the supplements to *The Festivus* updating Keen's (1971) *Sea Shells of Tropical West America*, will lead a

discussion, with audience participation, on identifying and understanding the taxonomy or classification of shells and give suggestions for caring of shell collections.

Meeting date: 20 May 1999

Shells of the month: Bring in your Panamic problem shells for Carol Skoglund to identify.

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CLUB NEWS

Big Spring Sale of Books, T-shirts, Sweatshirts and Shells

There will be a big sale of Club items both before and after the program during the May meeting. Books will be very reasonably priced along with Club t-shirts (\$8) and sweatshirts (\$10) while supplies last. Auction shells from the \$1-3 table will also be available - first come first served. Don't miss the opportunity to get in on these good deals!

The 1999 Auction/Potluck

It was a fantastic auction/potluck! Over 45 members and guests were in attendance enjoying the entire evening, from its beginning at 5 p.m. with "Dave's punch" (skillfully prepared by Bill Romer) and hors d'oeuvre while perusing the auction material, to dinner with outstanding food contributions, through the actual auction with accompanying silent auction and dollar tables. It was a wonderfully exuberant bunch that bid up a storm, as auctioneer Carole Hertz kept the momentum going, until the last item was sold at 10:45 p.m. Great fun was had by all.

Many people helped to make the auction a success. The auction committee, consisting of the Hutsells, Masons, Hertzes, Bill Romer, Kay Klaus, Margaret Mulliner, Silvana Vollero and Terry Arnold, prepared the auction specimens, set up and cleaned up, with assistance from other members, and many members and friends donated beautiful material to make the event a success. Those who donated shells and shell-related items to the auction are as follows: Terry Arnold; Ed Boyd; George Brosius; Jim Burbeck; Larry Catarius; Sally Fall; Wes Farmer; Carole and Jules Hertz; Linda and Kim Hutsell; John Jackson; Scott Jordan; Kirstie Kaiser; Kay Klaus; Marge and Ken Lindahl; Mike Mason; Margaret and Dave Mulliner; Barbara Myers; Rosemary and Frank Pierce; Don and Jeanne Pisor; Dale Roberts; Nancy and Bill Schneider; Carol Skoglund; Kent Trego; Virginia Upton and Gladys Weber.

A big "thank you" to all for making the evening a social and financial success.

The 1999 Greater San Diego Science and Engineering Fair

For the 27th consecutive year, the Club has participated in the Greater San Diego Science and Engineering Fair. The Club judges this year were Terry Arnold [chair], Hugh Bradner and Kim Hutsell.

They selected as the Club's winner Paras Bhakta, a 12th grader at Gompers High School, whose research topic was on heavy metal pollution in San Diego Bay. Paras Bhakta was also chosen a senior sweepstakes winner by the Science Fair judging committee.

Paras will choose a book award (offered each year by the Club), either Barnes' *Invertebrate Zoology*, Ricketts, Calvin & Hedgpeth's *Between Pacific Tides* or Morris, Abbott & Haderlie's *Intertidal Invertebrates of California*.

A date will be selected for Paras to present an overview of his winning project to the Club and receive the Club's book award of his choice.

Marine Life Exhibit

Club member Wes Farmer has a mixed media exhibit at Scripps Institution of Oceanography Library through June 1999. The beautiful display of his sculptures of crustaceans, swimming mollusks and the Gray Whale is near the entry on the main floor of the library

Too Late for the Roster

Catarius, Larry & Debbie, 4173 Galt St., San Diego, CA 92117, (619) 270-4376

Lavaleye, Marc, De Ruyterstraat 58, 1792 AK Oudeschild, The Netherlands. E-mail: lava@nioz.nl
Morrison, Hugh, c/o Perth Diving Academy, 283 Wanneroo Road, Notlamara, Western Australia 6061, Australia

Perrone, Antonio, Via Palermo 7, 73014 Gallipoli, Italy
Trego, Kent B., 441 Ravina St., Apt. #3, La Jolla, CA 92037, (619) 456-7655

New member

Scott, Mark, 1246 Firethorn St., San Diego, CA 92154-3813, (619) 662-2773. E-mail: shellman@home.com

THE ODD NORTHEAST PACIFIC RECORDS OF THE BIVALVE *ARCTICA ISLANDICA* (LINNAEUS, 1767): BAIT REMNANTS?

JOHN W. CHAPMAN¹

AND

TODD W. MILLER

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Hatfield Marine Science Center, Newport, OR 97365-5296, USA
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Discovery of the mechanisms that transport organisms around the world to where they can be introduced is critical to moderate their spread and proliferation. Odd records of *Arctica islandica* (Linnaeus, 1767) [Arcticidae], the ocean quahog from the north Atlantic, on the western U. S. coast may result from live seafood used as bait.

Remnants of seven valves of *Arctica islandica* were collected within a small area of poorly sorted gravel, cobble and mud in the high intertidal of the northeast corner of Humboldt Bay, California, (40°50'N, 124°04'W) by TM on 18 October 1998. The valves, consisting of a broken fragment, one 45 mm length valve, one 44 mm length valve, a 46 mm length pair, and a 48 mm length pair, are weathered but readily identifiable to species from the excellent figures provided in Coan (1998) and (Abbott, 1991). Three valves have been placed in the collections of the California Academy of Sciences, San Francisco (Invertebrate Zoology Catalogue No. 116031).

Live specimens or more shell remains were not recovered from the site despite a thorough search by extensive digging and careful inspection. The first record of northeast Pacific *Arctica islandica*, a 44 mm length pair of empty shells from a beach on the north side of Cape Kiwanda, Tillamook Co., Oregon, was found in the summer of 1998 (Coan 1998), over 500 km north of Humboldt Bay. The nine nearly identically sized valves, from both sites, are from a maximum of

six specimens. A subtidal search for living specimens has not been possible at either site and there is no evidence that the shells were from clams that were alive when cast off. These shells are therefore insufficient evidence that reproductive populations of the ocean quahog are established in the Pacific. However, they indicate that bait traffic may provide a pathway for *Arctica* dispersal from the Atlantic to the Pacific.

Similar ecological conditions may occur at both collection areas. Coan (1998) reports valves of the petricolid clam, *Petricola carditoides*, the cockle, *Protothaca staminea*, and the bay mussel, *Mytilus trossulus*, recovered from the Oregon collection site of *A. islandica*. These three native species also occur in the northwest corner of Humboldt Bay (Barnhardt *et al.*, 1992) where *A. islandica* was found. Moreover, the fresh condition of the Oregon shells found in summer and weathered condition of the more recently discovered California shells suggests that they may have been deposited at similar times, as would be expected if they are bait remnants.

Live *Arctica* are harvested commercially from northeastern Atlantic coastal waters (Kennis and Lutz, 1995) and shipped to retail stores throughout the United States (Coan, 1998). The *Arctica* shells are within the size range periodically available from seafood retail outlets (Christopher Schmidt, Pacific Seafood Company, Oregon, Personal communication). However, the possible odd origin of *A. islandica* on an Oregon beach

¹To whom all correspondence should be addressed.

from picnic refuse, suggested by Coan (1998), appears less likely with this new discovery. Whole clams are an unlikely item of picnics. The muddy, refuse littered, Humboldt Bay site is an extremely doubtful site for a picnic of any kind but is a frequent fishing site. The Cape Kiwanda Beach in Oregon may be a similar type of fishing site.

Ballast water from ships is an unlikely source of *Arctica* at either site. We are unaware of ballast water traffic between the Atlantic and Humboldt Bay and this mechanism of transport to the remote Oregon site is even less likely. There are also no records of intentional aquaculture introductions of *Arctica islandica* to the Pacific.

The risk of introducing *Arctica islandica* to the eastern Pacific as discarded, live bait could be significant. *Arctica islandica* occurs in shallow to deep subtidal marine waters from North Carolina to Labrador, and from France to Iceland in the west Atlantic (Abbott, 1991). *Arctica islandica* rarely occurs in temperatures exceeding 15.6°C (Kennis and Lutz, 1995). Low freshwater influences and significant tidal flushing result in full marine salinities and temperatures less than 15°C in the subtidal habitats of the northeastern Humboldt Bay (Barnhardt *et al.*, 1992). These conditions are also likely to prevail at Cape Kiwanda and are consistent with the environmental requirements of *A. islandica*.

At least one introduction from fresh seafood used as live bait has already occurred on the west coast of the U. S. The Chinese freshwater clam *Corbicula fluminea* may have been introduced to North America originally as a potential food source or accidentally in freshwater ballast from ships (Carlton, 1979). However, it is widely encountered on bay and ocean beaches as discarded fish bait (Coan and Carlton, 1975) where salinities are too high for survival. Much of the widespread dispersal of *Corbicula* in North America from the initial population very likely resulted from its use as bait (Carlton, 1975).

A cursory search revealed dozens of bivalve mollusks that are available as live seafood in western U.S. markets, of which approximately one third have already been introduced somewhere in the world. Up to 100% survival for 18 days is possible for live marketed clams with proper refrigeration and handling (Yin *et al.*, 1994). Twelve of 14 of the smooth venus, *Chione fluctifraga*, purchased from a grocery in Newport, Oregon, in an 18°C container of seawater opened and began suspension feeding within 12 hours.

Gourmet bivalves can be considered "beneficial" as seafood but also pose significant and unknown ecological and economic threats in areas where they are introduced by accident. Without sufficient biological assessment or quarantine and disease control, introduced bivalves can transfer parasites and pathogens that local species have no defenses for (Bower *et al.*, 1994; Barber, 1997) or profoundly alter the trophic dynamics of their new ecosystems (Griffiths *et al.*, 1992; Barber, 1997; Thayer *et al.*, 1997). Ironically, the native bivalves, *Petricola carditoides*, *Protothaca staminea* and *Mytilus trossulus* that occur at both *Arctica* recovery sites are probably equal or superior sources of bait at no cost. Thus, *Arctica islandica*, and all other imported live bivalve species are excellent seafood but poor choices for bait.

ACKNOWLEDGMENTS

We thank James T. Carlton, Williams College, Mystic, Connecticut, and Eugene V. Coan, California Academy of Sciences, San Francisco, for critical comments on the manuscript and the US EPA, Coastal Ecology Branch, Newport, Oregon, for use of facilities during the production of this paper. Katie Chapman, assisted with the clam survival experiment. Christopher Schmidt, Pacific Seafood Company, Portland, Oregon and Jeff Daniels, President, Marinelli Seafoods, Seattle, Washington, assisted in producing a list of commercially marketed live bivalve species. This work was partially supported by grant #NA36RG045, project #R/NIS-01-PD to JWC from the National Oceanic and Atmospheric Administration to the Oregon State University Sea Grant College Program and by appropriations made by the Oregon State legislature. The views expressed herein are those of the author(s) alone and do not necessarily reflect the views of NOAA, EPA or any of their subagencies or the views of any private companies.

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TWO STUDENT RESEARCH GRANTS OFFERED

The Western Society of Malacologists in conjunction with the Santa Barbara Malacological Society, the San Diego Shell Club, the Southwestern Malacological Society, and the Northern California Malacozoological Club are again pleased to announce the availability of research grants up to \$1000 to support student research in malacology. Funds are available for actual research costs, including but not limited to, field and laboratory equipment, chemicals, photographic supplies, computer time and supplies, microscope usage fees, and reasonable research travel costs.

Applicant must be a full time student in a formal graduate or undergraduate degree program. Research currently in progress or beginning in the 1998-1999 academic year will be considered.

The thesis, dissertation or research project must be focused primarily on the systematics, biology, ecology, physiology, biochemistry, or paleontology of marine, terrestrial or freshwater mollusks.

Completed applications must be received no later than 1 June 1999. No electronic submissions will be accepted. Awards will be announced by 15 August 1999.

Mail to: Malacology Grant, Department of Invertebrate Zoology, Santa Barbara Museum of Natural History, 2559 Puesta del Sol Road, Santa Barbara, CA 93105, USA. Application forms also available at <http://www.sbnature.org/wsmgrant.htm>

For further information contact: Henry Chaney at (805) 682-4711, ext. 334 (voice); (805) 963-9679 (fax); hchaney@sbnature2.org (e-mail).

The American Malacological Society will award grants of up to \$1000 in aid of student research. Both undergraduate and graduate students may apply. For instructions, see the AMS web site at <http://erato.acnatsci.org:80/ams/>

CORRECTION AND ADDITIONS TO "NOT ALL SHELLS IN BAJA CALIFORNIA ARE RECENT"

NANCY SCHNEIDER

12829 Carriage Road, Poway, California 92064-6045, USA

Tables 1 and 2 in "Not all shells in Baja California are Recent" (*The Festivus* 31(1): 3-16) contain an erroneous listing of *Cymatium lineatum* (Broderip, 1833). Table 1 should be corrected to read Keen no. 1064, *Coralliophila nux* (Reeve, 1846), and it should

not be placed in Table 2.

Additional species subsequently collected from the Late Pleistocene Mulegé Terrace and its environs include the following, which should be added to the species list in Table 1.

GASTROPODA								
Keen No.	Species	1	2	3	NPR	4	5	NPR
1515	<i>Conus perplexus</i> Sowerby, 1857						X	X
824	<i>Crucibulum personatum</i> Keen, 1958		X	X				
18	<i>Diodora inequalis</i> (Sowerby, 1825)	X			X			
996	<i>Maxwellia santarosana</i> (Dall, 1905)	X			X			
491	<i>Modulus cerodes</i> (A. Adams, 1851)			X	X	X		
950	<i>Morum tuberculatum</i> (Reeve, 1842, ex Sowerby MS)	X			X			
767	<i>Pilosabia pilosa</i> (Deshayes, 1832)	X		X	X			
1648	<i>Polystira oxytropis</i> (Sowerby, 1834)			X	X			
1525	<i>Terebra brandi</i> Bratcher & Burch, 1970			X	X			
BIVALVIA								
66	<i>Arca mutabilis</i> (Sowerby, 1833)					X		
455	<i>Chionopsis pulicaria</i> (Broderip, 1835)			X	X			
98	<i>Lunarca brevifrons</i> (Sowerby, 1833)		X		X		X	X
416	<i>Pitar paytensis</i> Orbigny, 1845					X		X
---	<i>Protothaca staminea</i> (Conrad, 1837)			X	X			
173	<i>Undulostrea megodon</i> (Hanley, 1846)	X						
POLYPLACOPHORA								
7	<i>Chiton virgulatus</i> Sowerby, 1840	X			X			

ADDITIONAL DISTRIBUTION RECORDS FOR *FAVARTIA (MUREXIELLA) ROSAMIAE* D'ATTILIO AND MYERS, 1985

BARBARA W. MYERS¹

Santa Barbara Museum of Natural History, 2559 Puesta del Sol Road,
Santa Barbara, California 93105-2936, USA

Favartia (Murexiella) rosamiae D'Attilio & Myers, 1985, is found in numerous island waters of the Indo-Pacific from the Philippine Islands and Ryukyu Islands, Japan (type localities) to Vava'u, Tonga (D'Attilio, 1989), as well as Zululand, South Africa; north of Mauritius; Seychelles; off Phuket, Thailand; Rabaul, New Guinea; Tioor Island, Moluccas; and New Caledonia (Houart, 1990). Houart and Tröndle (1997) note it from Nuku Hiva, Marquesas Islands, and I identified one specimen collected by Dr. Donald R. Shasky of Oceanside, California, from Ponape, Caroline Islands.

The newest record for this small muricid is Hibernia Reef off north Western Australia (11°58.204'S, 123°23.430'E) in 12-18 meters in dead coral shakings, collected by Kirstie L. Kaiser of Puerto Vallarta, Jalisco, México, and now in the Hertz Collection. I compared this specimen with the holotype (SDNHM 80742) and find them to be conspecific.

I thank Carole and Jules Hertz and Donald R. Shasky for allowing me to examine specimens in their collections and David K. Mulliner for photographing the specimen from Hibernia Reef.

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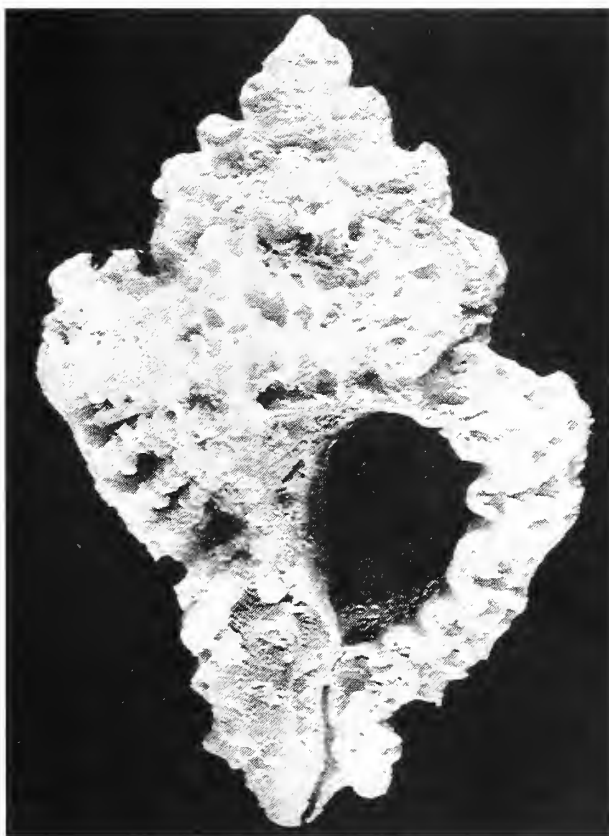


Figure 1. *Favartia rosamiae* D'Attilio & Myers, 1985, from Hibernia Reef, north Western Australia. Photo: D. K. Mulliner.

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¹ Mailing address: 3761 Mt. Augustus Avenue, San Diego, CA 92111, USA

ANNOUNCEMENT OF FIVE MALACOLOGICAL MEETINGS

Young Malacologists' Forum 1999

The Malacological Society of London holds the informal Young Malacologists' Forum each year to give young researchers an opportunity to meet with other malacologists, to compare notes on methods and problems and to present and discuss their research in a relaxed setting. This year the Forum will be held on 18 October beginning at 10 a.m. in the Mineralogy Seminar Room of The Natural History Museum, London.

For further information, e-mail Alex Ball: (a.ball@nhm.ac.uk).

Molluscs 2000

Understanding Molluscan Biodiversity in Our Region into the 21st Century will be the theme of the Molluscs 2000 meeting to be held in Sydney, NSW, Australia from 4-8 December 2000.

There will be three main symposia: Describing Molluscan Biodiversity - taxonomy and phylogeny and their role in biodiversity studies, organized by Drs. Winston Ponder, Peter Middelfart and Jeff Stilwell; Assessing Molluscan Biodiversity - ecology, life history and genetics, organized by Dr. Gee Chapman and Prof. Mike Johnson and Humans and Molluscan Biodiversity - impacts, commercial utilization, pests and diseases, organized by Dr. Wayne O'Connor and John Walker. There will also be an Open Session accepting papers on other aspects of Mollusca.

Look for further information on the website at <http://www.austmus.gov.au/science/division/invert/mal/malsoc/confer3.htm> For further information, e-mail: (gee@bio.usyd.edu.au).

The 1999 COA Convention

The 1999 Conchologists of America Convention will be held in Louisville, KY from 27 June to 1 July at The Galt House. Many of the traditional events will be held: a Welcome Party, Bourse, Auction, field trips and Banquet. This year's banquet speaker will be Dr. Emily Vokes. A new event is a World Record Size Event,

Parade of Champions. For further information, e-mail: (amconch@ix.netcom.com).

American Society of Malacologists

The AMS announces a special Workshop for Amateurs at their 65th annual meeting from 4-9 July at the Sheraton Station Square, Pittsburgh, PA. In addition to the symposia listed earlier, the Workshop will cover the ins and outs of database construction, led by Gary Rosenberg; amateur-professional relationships and how to get the most out of them, led by Jose Leal; incorporating amateur collections into a museum collection and curatorial help, led by Tim Pearce; collecting and maintaining a collection of freshwater mussels, led by Kevin Cummings and a review of literature in Malacology, led by Dick Petit.

For further information, see the AMS website <http://erato.acnatsci.org/ams/> or contact Charles F. Sturm, organizer of the Workshop, at 5024 Beech road, Murrysville, PA 15668 (csturmjr@pitt.edu).

32nd Annual Meeting of the Western Society of Malacologists

The 32nd Annual Meeting of the WSM will be held on the campus of California State University, Fullerton from 13-17 June. Scheduled events are an Opening Reception, three morning symposia and contributed papers and poster sessions, Reprint Sale and Auction, Banquet, featuring a talk by Kenneth Yates of the Aquarium of the Pacific in Long Beach, and Field Trip to the Santa Ana Mountains. The Fullerton Marriott Hotel, immediately adjacent to the campus, will serve as the social center for the meetings.

The three symposia are "Recent Advances in Molluscan Research," organized by Douglas Eernisse; "Invasive Molluscs: Environmental and conservation Impacts," organized by Jonathan Geller and "Current Research on West Coast Molluscan Paleontology," organized by Richard Squires and Lindsey Groves.

For further information, e-mail President Roger Seapy (rseapy@fullerton.edu).

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THE FESTIVUS

A publication of the San Diego Shell Club



ISSN 0738-9388

Volume: XXXI

June 10, 1999

Number: 6

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Address all correspondence to the San Diego Shell Club, Inc.,
c/o 3883 Mt. Blackburn Ave., San Diego, CA 92111, USA.

The Festivus is published monthly except December.
The publication date appears on the masthead above.
Single copies of this issue: \$5.00 plus postage.

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Meeting date: third Thursday, 7:30 PM,
Room 104, Casa Del Prado, Balboa Park, San Diego

PROGRAM

Relationships Between *Haliotis* Species

Dr. Victor D. Vacquier, professor of marine biology at Scripps Institution of Oceanography, has been researching the worldwide *Haliotis* species and

he will present an illustrated program on the haliotids; the relationships between species and how individual species evolve.

Meeting date: 17 June 1999
Shells of the month: Abalones

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CLUB NEWS

Minutes of the San Diego Shell Club Meeting - 20 May 1999

In Terry Arnold's absence, Vice President Mike Mason called the meeting to order at 7:45 p.m. and welcomed everyone. The minutes were approved as published in *The Festivus*, with a motion by Ed Boyd. Carole reminded everyone of the continuing need for articles and Mike mentioned some flyers on new publications for sale. There is still a need for a host.

Carole Hertz announced that the WSM is looking for donations for its auction in June. The money raised from that auction is used for student grants. Treasurer Linda Hutsell announced that the auction was the most successful ever partly due to the donation of three private collections to the Club.

Kim Hutsell, of the Club's Science Fair judging committee, introduced the Club's 1999 winner, Paras Bhakta, a 12th grader at Gompers High School, who gave an enthusiastic overview of his winning project on the effects of heavy metals on marine life. (In addition to winning the Club's book award, Paras also was a sweepstakes winner.)

For his project, Paras collected marine sediment from the Los Angeles area which contained a particular bacteria which he cultured. This bacteria, when introduced to water containing soluble chromium in the form of Cr6, reduced it to a non-soluble form Cr3. Everyone was fascinated with the extent and implications of his work. After his discussion, Carole presented him with an inscribed copy of his book choice, Rupert and Barnes' *Invertebrate Zoology*.

Mike then introduced Carol Skoglund, who led a discussion, with active participation from the those in attendance, on maintaining shell collections and the ins and outs of nomenclature. Carol emphasized the importance of keeping good data. When an "expert" has looked at one of her shells, she notes the person's name and date. She said she keeps her shells in small drawers so she can easily remove one to work on the shells and transport them. She said she has kept her shells in foam for years and has not had any problems. The group joined in the discussion and the issue of Byne's Disease was brought up. Acidity and humidity seem to be problems in the shell cabinet so air circulation is important.

Problems collectors have with nomenclature were explained and a helpful handout was distributed highlighting some of the difficult to understand concepts. There followed a lively discussion on recent changes in genera.

Many people agreed that habitat information is important though it is rarely included in the literature. It was noted that publications like *The Festivus* can provide that type of data.

Members were enjoying themselves so much they seemed to forget that they wanted to have refreshments. The delicious cookies were brought in by the Schneiders and the Hutsells. There was no shell drawing. Everyone left the meeting looking forward to our next opportunity to talk more about our favorite subject.

Silvana Vollero

New member

Stone, Sharon, 11546 Everston St., Norwalk, CA 90650. (562) 929-8812

Changes of address

Nelson, Lois, 7222 N. 15th Ave., Phoenix, AZ 85021-8658.

Kronenberg, Gijs, Den Bult 98, NL-5616 GJ Eindhoven, the Netherlands.

The September Party

A date has been set for the Club's annual September party, always a garden-type party. The festivities will again be held at the home of Marty and Terry Arnold, this year on Saturday evening, September 11th. Further details will be in the next issue.

1999 Directory of Conchologists/Malacologists

Tom Rice announces the 4th edition of his *Directory of Conchologists/Malacologists* which will be published this fall. The Directory is open to beginners, advanced amateur collectors, researchers and professional malacologists worldwide.

To be included, it is necessary to fill out an information form. Listings are free. Forms will be available at the June meeting or contact Tom Rice, Editor, P.O. Box 219, Port Gamble, WA 98364, USA. or e-mail: ofseashr@pacific.telebyte.com

REVISION OF *EUPROTOMUS* GILL, 1870.
2. ON THE IDENTITY OF *STROMBUS HIRASEI* KURODA, 1942
(GASTROPODA PROSOBRANCHIA: STROMBIDAE)

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Abstract

Strombus hirasei Kuroda, 1942, is known from only two specimens. It is here considered to be a hybrid of *Euprotomus vomer* (Röding, 1798) and *E. bulla* (Röding, 1798), as it shows shell characters intermediate between both supposed parent species.

Introduction

Kuroda (1942: 5-6, figs. 3,4) described *Strombus hirasei* as new to science. Abbott (1960: 130-132) synonymized this taxon with *Strombus (Euprotomus) vomer vomer* (Röding, 1798). This view was followed by most subsequent authors including Habe & Kosuge (1964: 9 as *S. (E.) vomer hirasei* in the synonymy), Romagna Manoja (1974: 7), Walls (1980: 189), and Kronenberg & Berkhout (1984: 296). Habe (1965: 37) considered Kuroda's species a distinct form of *Euprotomus vomer*, viz. *Euprotomus vomer* (Röding) forma *hirasei* Kuroda). Only Matsukuma (1991: 165) considered *E. hirasei* a full species, illustrating both holotype and paratype (op. cit.: pl. 34 figs. 4, 5).

Study of the English summarized description (Kuroda, 1942: 8, see below), and Habe's figure (op. cit.: pl. 16, fig. 1) of the paratype (Saito *in litt.*), raised some doubts as to the placement of Kuroda's taxon in the synonymy of *E. vomer*. Moreover, Kuroda (op. cit.: 8) mentions *S. vomer* as "not uncommon in Amami-Osima and in the Okinawa chain, ?Wakayama-Ken (Kii)", thus making a distinction between these two taxa.

Abbott never examined the holotype as he states:

"The type of *S. hirasei* Kuroda is presumably in the Kyoto University collection ..." (1960: 131). However, the type specimens (holotype and one paratype) were not listed in a series of papers by the Hanshin Shell Club (1986; 1996; 1997) (*vide* Hasegawa *in litt.*) and could have been presumed lost. Fortunately, Dr. Kazunori Hasegawa recovered the type specimens in the collection of the National Science Museum Tokyo (NSMT). Subsequently, Dr. Hiroshi Saito from NSMT sent the holotype on loan.

Original description

"General shape and a pale chestnut spot on the parietal callus as in *S. vomer (pacificus)*, but the spire slightly shorter, and its fore face (only) enameled, though not wholly concealed as in *bulla (guttatus)*; the striae and coloration of the aperture as in *aurisdianae*, differing merely in that it is slightly paler and clearer. The shell is less convex than that of *bulla*, with different nature of aperture. Whorls 9 in the type, apical one or two are broken off; immature whorls coloured violet. Alt. 68, larger diam. 38.5, lesser diam. 28 mm. (type). A smaller paratype measures 55 x 32 x 22.4 mm. Both specimens from Okinawa Islands, collected by the late Y. Hirase." (Kuroda, op. cit.: 8).

Discussion

In the original description (see above), *Strombus hirasei* was compared with both *E. vomer* and *E. bulla* as to shape, spire height, amount of callus on the spire, and color of the outer shell, and with *E. aurisdianae*

¹For the first part of this series see Vita Marina 45(2-4): 1-6.

(Linnaeus, 1758) regarding color of the aperture and plicae inside the aperture. The holotype of *S. hirasei* (Figures 2,5,8) has plicae on the whole of the adapertural side of the outer lip, adapically and adbasally strongest, obsolete in the middle, but still visible especially deeper within the aperture. *E. aurisdianae* has fewer and finer plicae, limited to the adapical (8-13) and adbasal (5-10) part of the lip (between the stromboid notch and the anterior canal), the lip is smooth in the middle.

When compared with *E. bulla* and *E. vomer*, *Strombus hirasei* shows characters that are intermediate between these two species. Some of these characters are listed here (Table 1). The reader is also referred to the illustrations (Figures 1-9).

It is concluded that the two specimens known as *Strombus hirasei* are hybrids of both *E. vomer* and *E. bulla*. The ICZN does not provide names for hybrids (art. 1b), and hence, the name *Strombus hirasei* (or *Euprotomus hirasei*) should not be used. Therefore I propose the following synonymy:

Euprotomus vomer (Röding, 1798) x *Euprotomus bulla* (Röding, 1798)
Strombus hirasei Kuroda, 1942: 5-6, 8, figs. 3,4;
Euprotomus vomer (Röding) possibility forma
hirasei (Kuroda). Habe, 1965: 37, pl. 16, fig. 1;
Euprotomus hirasei (Kuroda, 1942). Matsukuma,
 1991: 165, pl. 34 fig. 4 (paratype), fig. 5
 (holotype).

Remarks

The prime condition for hybridization in wild populations is the presence of both parent species. Both presumed parent species in this case of hybridization occur in the type locality of *Strombus hirasei*: *E. vomer* as well as *E. bulla* ("very common in the Okinawa chain ..." Kuroda, 1942: 8). *E. aurisdianae* is also reported from the RyuKyu Islands (Kuroda, 1942: 4, 8).

Hybrids are likely to have characteristics intermediate of both parental species. *Euprotomus aurisdianae* has very prominent sculpture on the dorsum, much more prominent than *E. vomer*. A hybrid of *E. aurisdianae* and *E. vomer* would have expressed itself in stronger dorsal sculpture. A hybrid of *E. bulla* and *E. aurisdianae* would have expressed itself in a lesser number and less strength of the plicae in the aperture. The possibility of *E. aurisdianae* being one of the parental species, seems very unlikely. *E. chrysostomus* (Kuroda, 1942) has shell characters

very much like *E. aurisdianae*, and, therefore, the possibility of this species as one of the parental species is unlikely as well.

There are a number of mechanisms which "prevent" hybridization. These are listed by Dubois (1988) and summarized by Futuyama (1986: 112). Therefore, hybrids are relatively rare. Except for the two type specimens, there are no other specimens present in NSMT (Saito *in litt.*). No other specimens of this presumed hybrid are known to the present author. This is not the first case of presumed hybridization in marine gastropods. One of the first well documented instances is in the paper by Owen *et al.* (1971) on eastern Pacific Haliotidae. Within the family Strombidae, Wolfe (1974: 5), Springsteen & Leobrera (1986: 69, pl. 16, fig. 6), and Kronenberg (1993) reported on *Lambis* and Man in 't Veld & Visser (1993: pl. 3, figs. 6, 6a) illustrated a presumed hybrid of *Strombus vittatus vittatus* x *Strombus campbelli*. Within *Euprotomus*, a possible hybrid of *E. aurisdianae* and *E. bulla* is known to the author (Kronenberg in prep.).

For some of the reports on (possible) hybridization within other marine gastropod families, see references in Kronenberg (1993).

Material examined

Holotype of *Strombus hirasei* and several specimens of *Euprotomus aurisdianae*, *E. bulla* and *E. vomer* from various private and public collections. These will be listed in a forthcoming part of this series (Kronenberg in prep.).

Acknowledgments

I am grateful to Mr. Bram van der Bijl (Zoölogisch Museum Amsterdam) for providing me with useful tips, Dr. Kazunori Hasegawa from NSMT for providing useful references and recovering the type material of *Strombus hirasei*, Dr. Hiroshi Saito from NSMT for sending the holotype of *S. hirasei* on loan and providing important information on the NSMT collection. The staff of Naturhistorisches Museum Basel (Switzerland) and Mr. Gerard Visser from Rotterdam, the Netherlands, made material available for study. Mr. Ron Voskuil from Delft, the Netherlands, made the photographs, and Dr. Th. Kemperman read a draft of the paper and made useful remarks. Dr. James H. McLean read the final draft and also made valuable remarks.

Table 1. Comparison of some of the characters of *E. vomer*, *E. bulla* x *E. vomer* (*E. hirasei*) and *E. bulla*

Character	<i>E. vomer</i>	<i>E. bulla</i> x <i>E. vomer</i> (<i>E. hirasei</i>)	<i>E. bulla</i>
ratio spire height to body whorl height	approx. 1:1	approx. 3:4	approx. 1:2
sculpture abapically of shoulder knobs on body whorl	narrow spiral cords	broad, spiral cords	(nearly) smooth
apertural sculpture	strong plicae	present, obsolete in middle	smooth, sometimes 1 or 2 obsolete in adapical part
aperture color	yellowish to orange-ochre	pale pink	reddish orange
spot on parietal callus	present, dark colored	present, pale colored	absent
callus on spire	poorly developed	slightly more as in <i>vomer</i>	callus covers spire
general shape	(relatively) elongated	intermediate	(relatively) squat

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PLATE 1, FIGURE LEGENDS

Figure 1. *Euprotomus vomer* (Röding, 1798), apertural view. Japan, Okinawa. Private collection Gijs C. Kronenberg 758. Height 59.4 mm.

Figure 2. *Euprotomus hirasei* (Kuroda, 1942). Japan, Okinawa. Holotype. NSMT 60925. Type locality: "Okinawa Islands" (Kuroda, 1942:8). Height 67.4 mm [different from measurement given by Kuroda because of slightly different method of measuring].

Figure 3. *Euprotomus bulla* (Röding, 1798). Japan, Riu Kiu Islands. ex Dr. Kanéco 948, Naturhistorisches Museum Basel 3358g. Height 54.6 mm.

Figure 4. *E. vomer*, specimen shown in Figure 1, profile view.

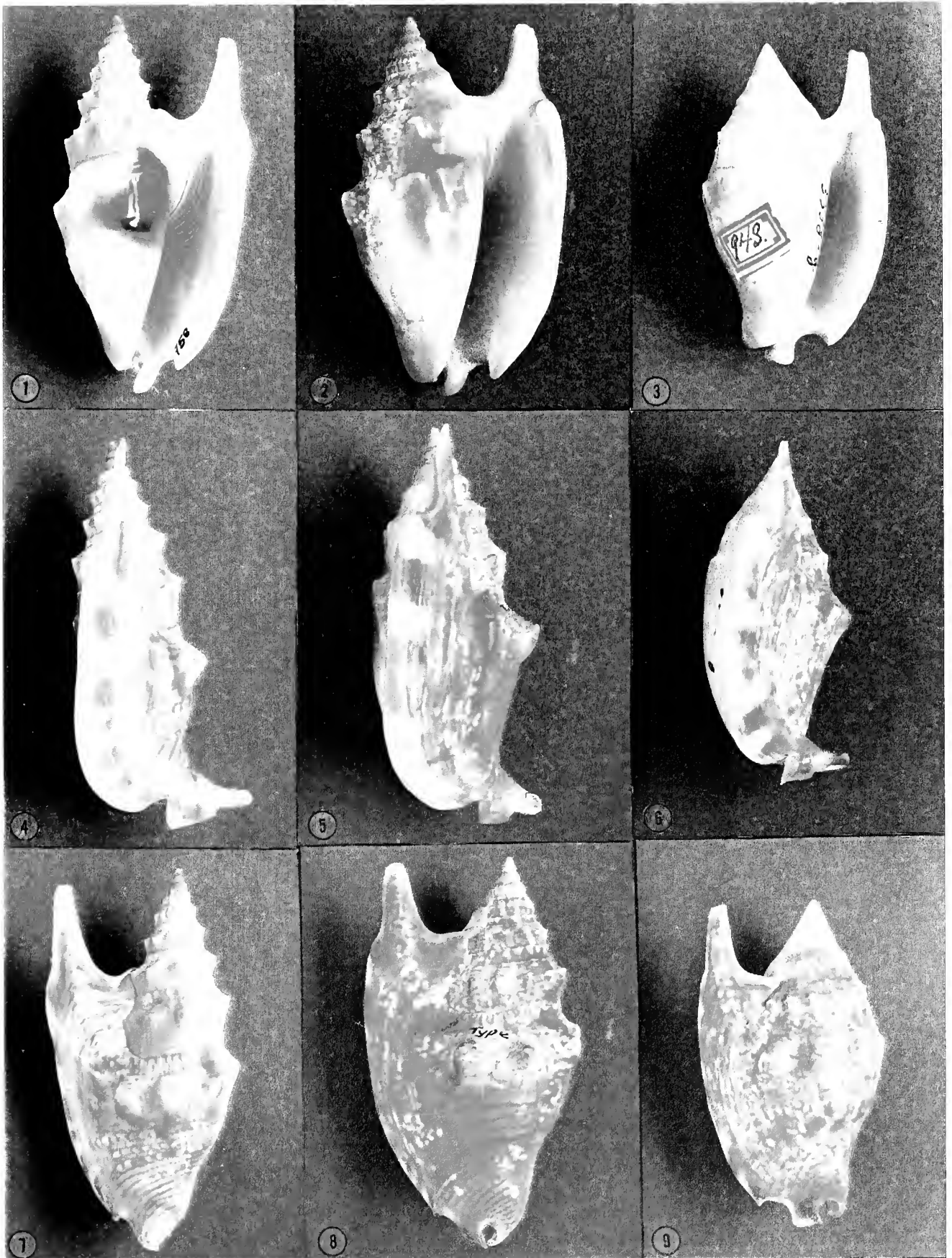
Figure 5. *E. hirasei*, specimen shown in Figure 2, profile view.

Figure 6. *E. bulla*, specimen shown in Figure 3, profile view.

Figure 7. *E. vomer*, specimen shown in Figure 1, dorsal view.

Figure 8. *E. hirasei*, specimen shown in Figure 2, dorsal view.

Figure 9. *E. bulla*, specimen shown in Figure 3, dorsal view.



POLYPLACOPHORA: CLASSIFICATION AND SYNONYMY OF RECENT (SUB)GENERA

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CLASSIFICATION AND SYNONYMY OF RECENT (SUB)GENERA

Class POLYPLACOPHORA Gray, 1821

Order NEOLORICATA Bergenhayn, 1955

Suborder LEPIDOPLEURINA Thiele, 1910

Family LEPTOCHITONIDAE Dall, 1889

Subfamily LEPTOCHITONINAE

Genus *LEPIDOPLEURUS* Leach MS, Risso, 1826, non Carpenter MS, Dall, 1882; type species: *Chiton cajetanus* Poli, 1791, SD

Genus *LEPTOCHITON* Gray, 1847; type species: *Chiton cinereus*; Montagu, 1803 (= *Chiton asellus* Gmelin, 1791)

Subgenus *LEPTOCHITON* s.s.

Syn. *Deshayesiella* Carpenter MS, Dall, 1879; *Lophyropsis* Thiele, 1893;

Beanella Thiele, 1893, non Dall, 1882;

Terenochiton Iredale, 1914; *Xiphiozona* Berry, 1919; *Nierstraszella* Sirenko, 1992;

Subgenus *PILSBRYELLA* Nierstrasz. 1905; type species: *Lepidopleurus* (P.) *setiger* Nierstrasz, 1905, OD

Subgenus *PARACHITON* Thiele, 1909; type species: *Lepidopleurus* (P.) *acuminatus* Thiele, 1909, OD

Genus *OLDROYDIA* Dall, 1894; type species:

Lepidopleurus (O.) *percrassus* Dall, 1894, M

Genus *HANLEYELLA* Sirenko, 1973; type species:

H. asiatica Sirenko, 1973, OD

Genus *FERREIRAELLA* Sirenko, 1988; type species:

F. caribbensis Sirenko, 1988, OD

Syn. *Abyssochiton* Dell'Angelo & Palazzi, 1989

Family HANLEYIDAE Bergenhayn, 1955

Genus *HANLEYA* Gray, 1857; type species: *Chiton hanleyi* Bean in Thorpe, 1844, M

Syn. *Laminoplax* Ferreira, 1981

Genus *HEMIARTHURUM* Carpenter in Dall, 1876;

type species: *H. setulosum* Carpenter in Dall, 1876, M

Genus *WEEDINGIA* Kaas, 1988; type species:

W. alborosea Kaas, 1988, OD

Genus *XYLOCHITON* Gowlett-Holmes &

Jones, 1992; type species: *X. xylophagus*

Gowlett-Holmes & Jones, 1992, OD

Suborder CHORIPLACINA Starobogatov & Sirenko, 1975

Family CHORIPLACIDAE Ashby, 1928

Genus *CHORIPLAX* Pilsbry, 1894; type species:

Microplax grayi H. Adams & Angas, 1864, OD

Syn. *Microplax* H. Adams & Angas, 1864 (preoccup.)

Suborder ISCHNOCHITONINA Bergenhayn, 1930

Family ISCHNOCHITONIDAE Dall, 1889

Subfamily ISCHNOCHITONINAE

Genus *ISCHNOCHITON* Gray, 1847; type species:

Chiton textilis Gray, 1828, SD

Subgenus *ISCHNOCHITON* s.s.¹

Syn. *Radiella* Pilsbry, 1892, non Thiele,

1893 (1); *Lophyriscus* Thiele, 1893 (2);

Leptopleura Thiele, 1893 (2); *Rhodoplax*

Thiele, 1893 (2); *Anisoradsia* Iredale &

May, 1916 (1); *Strigichiton* Hull, 1923

(2); *Autochiton* *Euporoplax*, *Euretoplax*,

& *Chartoplax*, all of Iredale & Hull, 1924

(2); *Levicoplax* Iredale & Hull, 1925 (2);

Dikuonus Ashby, 1931 (1); *Ovatoplax*

Cotton & Weeding, 1939 (2)

Subgenus *STENOSEMUS* von Middendorff,

1847; type species: *Chiton albus* Linnaeus,

1767, SD

Syn. *Lophyrus* G.O. Sars, 1876;

Chondropleura Thiele, 1906;

Lepidopleuroides Thiele, 1928;

Lophyrochiton Jakovleva, 1952

Subgenus *ISCHNORADSLA* Shuttleworth,

1853, non Carpenter MS, Dall, 1879; type

¹Van Belle (1974) has separated all *Ischnochiton* s.s. species in (1) *Ischnochiton* s.s.: species with insertion plates of intermediate valves multi-slitted, type *Chiton textilis* Gray, 1828 (2) *Simplischnochiton*: species with insertion plates of intermediate valves single-slitted, type *Ischnochiton maorianus* Iredale, 1914, OD.

- species: *Chiton australis* Sowerby, 1840, SD
Syn. *Lepidoradsia* Carpenter MS, Dall, 1879
- Subgenus *HETEROZONA* Carpenter MS, Dall, 1879; type species: *Ischnochiton* (H.) *cariosus* Carpenter in Pilsbry, 1892, SD
- Subgenus *HAPLOPLAX* Pilsbry, 1894; type species: *Lophyrus smaragdinus* Angas, 1867, OD
Syn. *Radsia* Thiele, 1893, *non* Pilsbry, 1892
- Genus *STENOCHITON* H. Adams & Angas, 1864; type species: *S. juloides* H. Adams & Angas, 1864 (= *Chiton longicymba* de Blainville, 1825), M
Syn. *Zostericola* Ashby, 1919
- Genus *STENOPLAX* Dall, 1879; type species: *Chiton limaciformis* Sowerby, 1832, OD
- Subgenus *STENOPLAX* s.s.
- Subgenus *STENORADSIA* Carpenter MS, Dall, 1879; type species: *Chiton magdalenensis* Hinds, 1844, OD
Syn. *Maugerella* Carpenter MS, Dall, 1879
- Genus *LEPIDOZONA* Pilsbry, 1892; type species: *Chiton mertensii* von Middendorff, 1847, OD
- Subgenus *LEPIDOZONA* s.s.
Syn. *Lepidopleurus* Carpenter MS, Dall, 1879, *non* Leach MS, Risso, 1826;
Solivaga Iredale & Hull, 1925; *Isochiton* Ashby & Cotton, 1934
- Subgenus *TRIOPLAX* Berry, 1919; type species: *Trachydermon trifidus* Carpenter, 1864, OD
Syn. *Ischnoradsia* Carpenter MS, Dall, 1879, *non* Shuttleworth, 1853;
Rhombochiton Berry, 1919; *Gurjanovillia* Jakovleva, 1952; *Albrechtia* Is. Taki, 1955
- Genus *CONNEXOCHITON* Kaas, 1979; type species: *C. platynomenus* Kaas, 1979, OD
Syn. *Bathychiton* Dell'Angelo & Palazzi, 1988
- Genus *THERMOCHITON* Saito & Okutani, 1990; type species: *T. undocostatus* Saito & Okutani, 1990, OD
- Genus *VERMICHITON* Kaas, 1991; type species: *V. vermiculus* Kaas, 1991, OD
- Subfamily CALLISTOPLACINAE Pilsbry, 1893
- Genus *ISCHNOPLAX* Carpenter MS, Dall, 1879; type species: *Chiton pectinatus* Sowerby, 1840, OD
Syn. *Stereoplax* Thiele, 1893
- Genus *CALLISTOCHITON* Dall, 1879; type species: *C. palmulatus* Carpenter MS, Dall, 1879, M
Syn. *Lophochiton* Ashby, 1923, *non* Berry, 1925; *Callistelasma* & *Callistassecla* both Iredale & Hull, 1925
- Genus *CALLISTOPLAX* Dall, 1882; type species: *Chiton retusus* Sowerby, 1832, OD
- Genus *CERATOZONA* Dall, 1882; type species: *Chiton guildingii* Reeve, 1847 (= *Chiton squalidus* C.B. Adams, 1845), OD
Syn. *Ceratophorus* Carpenter MS, Dall, 1879 (preoccup.); *Newcombia* Carpenter MS, Dall, 1882 (preoccup.);
- Genus *CALLOPLAX* Thiele, 1909; type species: *Chiton janeirensis* Gray, 1828, OD
- Subfamily CHAETOPLEURINAE Plate, 1989
- Genus *CHAETOPLEURA* Shuttleworth, 1853; type species: *Chiton peruvianus* Lamarck, 1819, SD
- Subgenus *CHAETOPLEURA* s.s.
Syn. *Lepidochiton* Carpenter, 1857;
Variolepis Plate, 1899; *Typhlochiton* Dall, 1921
- Subgenus *PALLOCHITON* Dall, 1879; type species: *P. lanuginosus* Carpenter MS, Dall, 1879, M
Syn. *Hemphillia* Carpenter MS, Dall, 1879 (preoccup.); *Arthuria* Carpenter MS, Dall, 1882; *Helioradsia* Thiele, 1893
- Genus *DINOPLAX* Carpenter MS, Dall, 1882; type species: *Chiton gigas* Chemnitz (= *Chiton gigas* Gmelin, 1791), OD
- Genus *NUTTALLOCHITON* Carpenter MS, Dall, 1882; type species: *Schizochiton hyadesi* Plate, 1899 (= *Tonicia martiali* de Rochebrune, 1889), OD
Syn. *Notochiton* Thiele, 1906
- ?Genus *LELOUPIA* Kaas & Van Belle, 1990; type species: *Leptochiton belgicae* Pelseneer, 1903, OD
- Subfamily CALLOCHITONINAE Plate, 1901
- Genus *CALLOCHITON* Gray, 1847; type species: *Chiton laevis* Montagu, 1803 (= *Chiton septemvalvis* Montagu, 1803), SD
Syn. *Clathropleura* Tiberi, 1877, *non* Thiele, 1893; *Trachyradsia* Carpenter MS, Dall, 1878; *Stereochiton* Carpenter MS, Dall, 1882; *Icoplax* Thiele, 1893;
Scrobicoplax & *Paricoplax* both Iredale & Hull, 1929; *Acutoplax* Cotton & Weeding, 1939
- Genus *EUDOXOCHITON* Shuttleworth, 1853; type species: *Acanthopleura nobilis* Gray, 1843, M
- Subgenus *EUDOXOCHITON* s.s.
- Subgenus *EUDOXOPLAX* Iredale & May, 1916; type species: *Chiton inornatus* Tenison Woods, 1881, OD
- ?Genus *QUAESTIPLAX* Iredale & Hull, 1929; type species: *Q. wilsoni* Iredale & Hull, 1929, OD
- Subfamily LEPIDUCHITONINAE Iredale, 1914
- Genus *LEPIDOCHITONA* Gray, 1821; type species: *Chiton marginatus* Pennant, 1777 (= *Chiton cinereus* Linnaeus, 1767), M
- Subgenus *LEPIDOCHITONA* s.s.
Syn. *Trachydermon* Carpenter, 1864;
Craspedochilus G. O. Sars, 1878;

- Dawsonia* Carpenter MS, Dall, 1879 (preoccup.); *Beania* Carpenter MS, Dall, 1879 (preoccup.); *Middendorffia* Carpenter MS, Dall, 1882; *Beanella* Dall, 1882, non Thiele, 1893; *Cyanoplax* Pilsbry, 1892; *Leptochitona* Pilsbry, 1893; *Adriella* & *Mopaliopsis* both of Thiele, 1893; *Mopaliella* Thiele, 1909; *Lophochiton* Berry, 1925, non Ashby, 1923; *Ploiochiton* Berry, 1926; *Trachochiton* Risbec, 1946
- Subgenus *SPONGIORADSIA* Pilsbry, 1894; type species: *Trachydermon* (*Trachyradsia*) *aleutica* Dall, 1878, OD
- Subgenus *DENDROCHITON* Berry, 1911; type species: *Mopalia* (*D.*) *thamnopora* Berry, 1911, OD
- Syn. *Basiliochiton* Berry, 1918
- Genus *NUTTALLINA* Carpenter MS, Dall, 1871; type species: *Chiton scaber* Reeve, 1847 (= *Chiton californicus* Nuttall MS, Reeve, 1847), M
- Genus *TONICELLA* Carpenter, 1873; type species: *Chiton marmoreus* Fabricius, 1780, SD
- Syn. *Boreochiton* G. O. Sars, 1878
- Genus *TONICINA* Thiele, 1906; type species: *Chiton zschau* Pfeffer, 1886, M
- Genus *SUBTERENOCHITON* Iredale & Hull, 1924; type species: *Ischnochiton gabrieli* Hull, 1912, OD
- Genus *JUVENICHITON* Sirenko, 1975; type species: *J. albocinnamomeus* Sirenko, 1975 (= *Tonicella saccharina* Dall, 1878), OD
- Syn. *Micichiton* & *Nanichiton* both of Sirenko, 1975
- Genus *PARTICULAZONA* Kaas, 1993; type species: *P. milnei* Kaas, 1993, OD
- Subfamily SCHIZOPLACINAE Bergenhayn, 1955
- Genus *SCHIZOPLAX* Dall, 1878; type species: *Chiton brandtii* von Middendorff, 1847, OD
- Family MOPALIIDAE Dall, 1889
- Subfamily MOPALIINAE
- Genus *MOPALIA* Gray, 1847; type species: *Chiton hindsii* Sowerby MS, Reeve, 1847, SD
- Syn. *Osteochiton* Dall, 1886
- Genus *PLAXIPHORA* Gray, 1847; type species: *Chiton carmichaelis* Gray, 1828 (= *Chiton auratus* Spalowsky, 1795), SD
- Subgenus *PLAXIPHORA* s.s.
- Syn. *Euplaxiphora* Shuttleworth, 1853; *Guildingia* Carpenter MS, Dall, 1882; *Diaphoroplax*, *Poneroplax* & *Maorichiton* all of Iredale, 1914; *Semimopalia* Dall, 1919; *Aerilamma* Hull, 1924; *Vaferichiton* Iredale & Hull, 1932; *Hachijomopalia* Is. Taki, 1954
- Subgenus *FREMBLYA* H. Adams, 1866; type species: *F. egregia* H. Adams, 1866, M
- Syn. *Streptochiton* Carpenter MS, Dall, 1879 (*nom. nud.*); *Kopionella* Ashby, 1919
- Subgenus *MERCATORA* Leloup, 1936; type species: *Plaxiphora* (*Poneroplax*) *mercatoris* Leloup, 1936, OD
- Genus *AMICULA* Gray, 1847; type species: *Chiton vestitus* Broderip & Sowerby, 1829, SD
- Syn. *Cryptochiton* Gray, 1847, non von Middendorff, 1847; *Symmetrogephyrus* von Middendorff, 1847; *Stimpsoniella* Carpenter, 1873; *Chlamydochiton* Dall, 1878; *Chlamydoconcha* Pilsbry, 1893
- Genus *PLACIPHORELLA* Carpenter MS, Dall, 1879; type species: *P. velata* Carpenter MS, Dall, 1879, OD
- Syn. *Euplaxiphora* Verrill & Smith, 1882; ?*Trochodochiton* de Rochebrune, 1884; *Placophoropsis* Pilsbry, 1893; *Langfordiella* Dall, 1925
- Genus *PLACIPHORINA* Kaas & Van Belle, 1994; type species: *P. gowlettholmesae* Kaas & Van Belle, 1994, OD
- Subfamily KATHARININAE Jakovleva, 1952
- Genus *KATHARINA* - Gray, 1847; type species: *Chiton tunicatus* Wood, 1815, SD
- Family SCHIZOCHITONIDAE Ball, 1889
- Genus *SCHIZOCHITON* Gray, 1847; type species: *Chiton incisus* Sowerby, 1841, M
- Genus *LORICA* H. & A. Adams, 1852; type species: *Chiton cimolius* Reeve, 1847 (= *Chiton volvox* Reeve, 1847), M
- Syn. *Aulacochiton* Shuttleworth, 1853; *Zeloric* Finlay, 1927
- Genus *LORICELLA* Pilsbry, 1893; type species: *Lorica angasi* H. Adams in H. Adams & Angus, 1864, M
- Syn. *Squamophora* Nierstrasz, 1905; *Componochiton* Milne, 1963; *Sinolorica* Xu, 1990
- Family CHITONIDAE Rafinesque, 1815
- Subfamily CHITONINAE
- Genus *CHITON* Linnaeus, 1758; type species: *C. tuberculatus* Linnaeus, 1758, SD
- Subgenus *CHITON* s.s.
- Syn. *Scutigerulus* Meuschen, 1787; *Amaurochiton*, *Chondroplax*, *Diochiton*, *Poeciloplax*, *Sypharochiton*, *Triboplax* & *Georgus* all of Thiele, 1893
- Subgenus *RADSIA* Gray, 1847; type species: *Chiton barnesii* Gray, 1828, SD
- Subgenus *RHYSSOPLAX* Thiele, 1893; type species: *Chiton janeirensis* Thiele, 1893 (= *Chiton affinis* Issel, 1869), SD
- Syn. *Clathropleura* Thiele, 1893, non Tiberi, 1877; *Anthochiton* Thiele, 1893; *Delicatoplax* Iredale & Hull, 1926

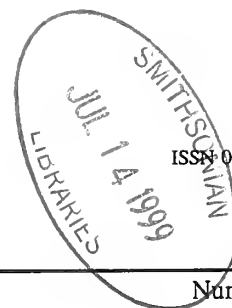
- Subgenus *TEGULAPLAX* Iredale & Hull, 1926; type species: *Chiton howensis* Iredale & Hull, 1926 (= *Ischnochiton hululensis* E. A. Smith, 1903), OD
- Subgenus *MUCROSQUAMA* Iredale & Hull, 1926; type species: *Chiton carnosus* Carpenter MS, Angas, 1867, OD
- Subfamily ACANTHOPLEURINAE Dall, 1889
- Genus *ACANTHOPLEURA* Guilding, 1829; type species: *Chiton spinosus* Bruguière, 1792, SD
- Syn. *Corephium* Gray, 1847 (preoccup.); *Maugeria* Gray, 1857; *Francisia* Carpenter MS, Dall, 1882; *Rhopalopleura* Thiele, 1893; *Amphitomura* & *Mesotomura* both of Pilsbry, 1893; *Acanthozostera* Iredale & Hull, 1926; *Planispina* Iw. Taki MS, Is. Taki, 1962
- Genus *ENOPLOCHITON* Gray, 1847; type species: *Chiton niger* Barnes, 1824, M
- Genus *LIOLOPHURA* Pilsbry, 1893; type species: *Chiton japonicus* Lischke, 1873, OD
- Subgenus *LIOLOPHURA* s.s.
- Subgenus *CLAVARIZONA* Hull, 1923; type species: *Chiton hirtosus* Péron MS, de Blainville, 1825, OD
- Subgenus *SQUAMOPLEURA* Nierstrasz, 1905; type species: *S. imitator* Nierstrasz, 1905 (= *Sclerochiton miles* Carpenter in Pilsbry, 1893), SD
- Syn. *Sclerochiton* Carpenter MS, Dall, 1882 (preoccup.)
- Subfamily TONICIINAE Pilsbry, 1893
- Genus *TONICIA* Gray, 1847; type species: *Chiton elegans* Frembly, 1827 (= *Chiton chilensis* Frembly, 1827), SD
- Subgenus *TONICIA* s.s.
- Syn. *Tonichia* Gray, 1840 (nom. nud.); *Fannyia* Gray, 1857 (preoccup.); *Fannettia* Dall, 1882
- Subgenus *LUCILINA* Dall, 1882; type species: *Chiton confossus* Gould, 1846 (= *Chiton lamellosus* Quoy & Gaimard, 1835), SD
- Syn. *Lucia* Gould, 1862 (preoccup.); *Toniciopsis* Thiele, 1893
- Genus *ONITHOCHITON* Gray, 1847; type species: *Chiton undulatus* Quoy & Gaimard, 1835 (= *Onithochiton neglectus* de Rochebrune, 1881), SD
- Syn. *Pristochiton* Clessin, 1904; *Onithoplax* Thiele, 1910; *Onithella* Mackay, 1933; *Nodioplax* Beu, 1967
- Suborder ACANTHOCHITONINA Bergenhayn, 1930
- Family CRYPTOPLACIDAE H. & A. Adams, 1858
- Genus *CRYPTOPLAX* de Blainville, 1818; type species: *Chiton larvaeformis* de Blainville MS, Burrow, 1815, SD
- Syn. *Chitonellus* Lamarck, 1819, non de Blainville, 1825; *Oscabrella* Broderip, 1836; *Chitoniscus* Herrmannsen, 1846, non Carpenter MS, Dall, 1882; *Phaenochiton*, *Dichachiton* & *Ametrogephyrus* all of von Middendorff, 1847
- Genus *CHONEPLAX* Carpenter MS, Dall, 1882; type species: *Chiton strigatus* Sowerby, 1840 (= *Chitonellus latus* Guilding, 1829), OD
- Syn. *Chitoniscus* Carpenter MS, Dall, 1882, non Herrmannsen, 1846
- Family ACANTHOCHITONIDAE Pilsbry, 1893
- Subfamily ACANTHOCHITONINAE
- Genus *CRYPTOCONCHUS* de Blainville MS, Burrow, 1815; type species: *Chiton porosus* de Blainville MS, Burrow, 1815, SD
- Genus *ACANTHOCHITONA* Gray, 1821; type species: *Chiton fascicularis* Linnaeus, 1767, M
- Syn. *Gymnoplax* Gray, 1821; *Chitonellus* de Blainville, 1825, non Lamarck, 1819; *Acanthochites* Leach MS, Risso, 1826; *Phakellopleura* Guilding, 1829; *Hamachiton* & *Platysemus* both of von Middendorff, 1847; *Strechochiton* A. Adams MS, Tapparone-Canefri, 1874; *Siectoplax* Carpenter MS, Dall, 1882; *Meturolax* Pilsbry, 1894; *Americhiton* Watters, 1990
- Genus *CRASPEDOCHITON* Shuttleworth, 1853; type species: *Chiton laqueatus* Sowerby, 1841, M
- Syn. *Angasia* Carpenter MS, Dall, 1882 (preoccup.); *Phacellozona* Pilsbry, 1894; *Craspedoplax* Iredale & Hull, 1925; *Amblyplax* & *Lophoplax* both of Ashby, 1926
- Genus *NOTOPLAX* A. Adams, 1861; type species: *Cryptoplax* (N.) *speciosa* H. Adams, 1861, M
- Subgenus *NOTOPLAX* s.s.
- Syn. *Phacellopleura* & *Macandrellus* both of Carpenter MS, Dall, 1879; *Leptoplax* Carpenter MS, Dall, 1882; *Loboplax* Pilsbry, 1893; *Mecynoplax* Thiele, 1893; *Aristochiton* Thiele, 1909; *Pseudotonicia* Ashby, 1928; *Ikedaella* Is. & Iw. Taki, 1929; *Crocochiton* Cotton & Weeding, 1939
- Subgenus *SPONGIOCHITON* Carpenter MS, Dall, 1882; type species: *S. productus* Carpenter in Pilsbry, 1892, M
- Syn. *Thaumastochiton* Thiele, 1909
- Subgenus *BASSETHULLIA* Pilsbry, 1928; type species: *Acanthochites matthewsi* Bednall & Pilsbry in Pilsbry, 1894, OD
- Syn. *Glyptelasma* Iredale & Hull, 1925 (preoccup.)
- Subfamily CRYPTOCHITONINAE Pilsbry, 1893
- Genus *CRYPTOCHITON* von Middendorff, 1847, non Gray, 1847; type species: *Chiton stelleri* von Middendorff, 1847, SD

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THE FESTIVUS

A publication of the San Diego Shell Club



Volume: XXXI

July 15, 1999

Number: 7

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Membership (includes family). Domestic \$15.00;
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Mexico/ Canada (surface mail): \$18.00, (air mail): \$20.00.
Address all correspondence to the San Diego Shell Club, Inc.,
c/o 3883 Mt. Blackburn Ave., San Diego, CA 92111, USA.

The *Festivus* is published monthly except December.
The publication date appears on the masthead above.
Single copies of this issue: \$5.00 plus postage.

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Meeting date: third Thursday, 7:30 PM,
Room 104, Casa Del Prado, Balboa Park, San Diego

PROGRAM

The Most Successful Cleaning Techniques for Shells -- A Discussion

Kim Hutsell, Club member and publisher, will lead a discussion on the care and cleaning of shells - both inside and out. He will bring examples of cleaning tools

and discuss the dos and don'ts of preparing shells for the collection. It is anticipated that members will bring their expertise and problems to the discussion.

Meeting date: 17 July 1999
Shells of the month: local shells

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Carole M. Hertz, Barbara W. Myers, Joyce Gemmell & Daniel L. Geiger	75

CLUB NEWS

Minutes of the San Diego Shell Club Meeting - 17 June 1999

President Terry Arnold opened the meeting at 7:45 p.m. by welcoming everyone. Approximately 21 members were in attendance. The minutes were approved as published in *The Festivus*. Terry reminded everyone that the September Party will be at his house and that the potluck will include a variety of hors d'oeuvres. The Christmas Party will be on Saturday evening December 4th.

Vice President Mike Mason introduced the speaker for the evening, Dr. Victor D. Vacquier, professor of marine biology at Scripps Institution of Oceanography. Vic, who has studied worldwide *Haliotis* species, spoke on the Relationships Between *Haliotis* Species. He stated that little is known about fertilization on a molecular basis; we know the most about abalones, sea urchins and mice. *Haliotis* evolved rapidly and their fertilization is species specific. There is one region in the lysines (the amino acid) which is different in each of the species. In the eastern Pacific there are four modern species (less than one million years old); these are the white (*H. sorenseni*), the pinto (*H. kamtschatkana*), the flat (*H. walallensis*), and the red (*H. rufescens*).

While the topic was very technical, Vic utilized simplified diagrams and everyday language, even using a spatula unclaimed after the Club auction, to help the audience visualize the information. It was a fascinating talk followed by many questions from the audience.

The winner of the door prize was Jules Hertz. Refreshments for the evening were contributed by Terry Arnold. The meeting was adjourned to enjoy the refreshments and to look at the books, shells and tee shirts on sale.

Silvana Vollero

New Book Received for the Club Library

The Club has received a copy of the new book, *A Field Guide to Marine Molluscs of Galápagos* by Cleveland P. Hickman, Jr. and Yves Finet. This book is a part of the Galápagos Marine Life Series just published this year. It is currently being reviewed and will be available in the Club library shortly.

A Club Host is Still Needed

The Club is still in need of a Club host. Bill Romer has been helping until a member offers to act as host. It is not a difficult job, but certainly makes a difference at refreshment time. Won't someone come forward?

Shell and Book Sale

There will be books and shells for sale at the July meeting. Come and enjoy browsing at the books and shells. Also available are Club t-shirts and sweatshirts.

The September Party

It's a grazing party!! The garden party with "heavy" hors d'oeuvres will be held on Saturday evening September 11th beginning at 6 p.m. Marty and Terry Arnold have again graciously offered their home and garden for the event. There will be a sign-up sheet at the July and August meetings and further details. A map will be included in the August issue.

Too Late for the Roster

Reitz, Chuck, 410 Orpheus Ave., Leucadia, CA 92024, (760) 943-1029(home), (760) 471-8657 (work), FAX (760) 471-6894

Changes of Address

Kaiser, Kirstie L., Paseo de las Conchas Chinas #115, dept.4, Puerto Vallarta, Jalisco, C.P. 48390, Mexico
Romer, Bill [change of e-mail], wromer@san.rr.com

Maybe You've Noticed

The Club now has shells, books, magazines and reprints on display and for sale at each Club meeting. All articles have been donated to the Club and are there to make the evening even more interesting and sales benefit Club projects. All items are marked with their prices and payment is on the honor system. Just dump the money in the jar. Also available in some sizes, while they last, are Club tee shirts and sweatshirts at a price of \$8 and \$10 respectively.

A DISCUSSION OF THREE *FUSINUS* SPECIES IN THE NORTHERN GOLFO DE CALIFORNIA AT SAN FELIPE

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Abstract: Three similar-looking *Fusinus* species, *Fusinus ambustus* (Gould, 1853), *F. fredbakeri* Lowe, 1935, and *F. consagensis* Poorman, 1981, reported from the San Felipe area in the northern Golfo de California, were examined and compared to other fusinid species from the region. Characters of the protoconch, the teleoconch, the periostracum, the operculum, and the radula were used. *Fusinus ambustus* can readily be distinguished from the other two species, and is not normally found in the San Felipe area. Both nominal species, *F. fredbakeri* and *F. consagensis*, occur there together, intertidally. Due to the absence of discrete differences between the two latter species, and following the results of shell morphometric analysis, we place *F. consagensis* in synonymy of *F. fredbakeri*.

Introduction: In our continuing study of material from the San Felipe area, Baja California, México, we have periodically reported on interesting molluscan occurrences in the San Felipe area (e.g., Gemmell, Hertz & Myers, 1980; Gemmell, Myers & Hertz, 1987; Hertz, Myers & Gemmell, 1985, 1992; Myers, Hertz &

Gemmell, 1990).

In studying the family Fasciolariidae, we discovered that in addition to *Fusinus felipensis* Lowe, 1935, and *F. fredbakeri* Lowe, 1935, Gemmell collected over 170 living specimens of a fusinid then identified as *Fusinus ambustus* (Gould, 1853).

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The three similar-appearing species occurring in the northern Golfo de California are *F. ambustus*, *F. consagensis*, and *F. fredbakeri*. *Fusinus hertleini* Lowe, 1935, *F. h. albescens* Lowe, 1935, and *F. h. bruneocincta* Lowe, 1935, are considered synonyms of *F. ambustus* according to Keen (1958, 1971). Hertz (1986:32-33) illustrated the paratypes of *F. h. albescens* and *F. h. bruneocincta*.

The identity of *F. ambustus* at San Felipe has been controversial. Prior to the description of *F. consagensis*, all fusinids over 40 mm in the San Felipe area were identified as *F. ambustus* (DuShane, 1962; DuShane & Sphon, 1968; DuShane & Brennan, 1969; Gemmell, 1973). Poorman (1981) described the deep-water specimens as *F. consagensis*, *F. fredbakeri* being the intertidal species.

Additional *Fusinus* species occurring in the Panamic region include: *F. cinereus* (Reeve, 1847), *F. colpoicus* Dall, 1915, *F. irregularis* Grabau, 1904, *F. dupetitthouarsi* Kiener, 1840 [Keen, 1971: fig. #1340, right], *F. felipensis* Lowe, 1935, *F. turris* Valenciennes, 1832 [Keen, 1971: fig. #1340, left], *F. panamensis* Dall, 1908, and *F. allyni* McLean, 1970, a species restricted to the Islas Galápagos and Isla del Coco.

Materials and Methods

Abbreviations: American Museum of Natural History (AMNH); Barbara Myers Collection (BMC); Carol Skoglund Collection (CSC); Donald Shasky Collection (DSC); Gemmell Collection (GC); Hertz Collection (HC); Los Angeles County Museum of Natural History (LACM); Mulliner Collection (MC); Santa Barbara Museum of Natural History (SBMNH); San Diego Natural History Museum (SDNHM).

Specimens: *Fusinus consagensis*: holotype (LACM 1934), 52 paratypes (SBMNH 143259, 143257, ex Poorman collection; AMNH 221949, 198963; CSC (no number), various specimens in GC, HC, and CSC. *Fusinus ambustus*: illustration of the type of *F. ambustus*, because the repository of the type is unknown (Johnson, 1964), SDNHM 50950 (holotype of *F. hertleini*, synonym of *F. ambustus*), SDNHM 50949 (paratype of *F. h. albescens*, synonym of *F. ambustus*), SDNHM 44070 (paratype of *F. h. bruneocincta* synonym of *F. ambustus*), various specimens in the SDNHM, CSC, HC, and BMC. *Fusinus fredbakeri*: holotype (SDNHM 50951), 23 paratypes (SDNHM 50955), various specimens in SDNHM (ex GC), CSC, HC, MC, DSC. A total of 377 specimens of comparative material from San Felipe was examined; 333 were measured and used for the statistical analysis

(Table 1).

Statistics: All statistical analyses were carried out with Statistica Mac 4.1 (Statsoft, 1994). One outlier was removed with Grubbs test (Sokal & Rohlf, 1981) using critical values furnished by Rohlf & Sokal (1981) at $p < 0.005$. All raw variables, Length (L), Width (W) and Canal Length (C), were transformed into ratios (L/W, C/L, C/W), and the normality for each nominal taxon was tested with Komolgorov-Smirnov and Liliefors tests. Cluster analysis was of the k-means type. Various (M)AN(C)OVA designs are identified in the text.

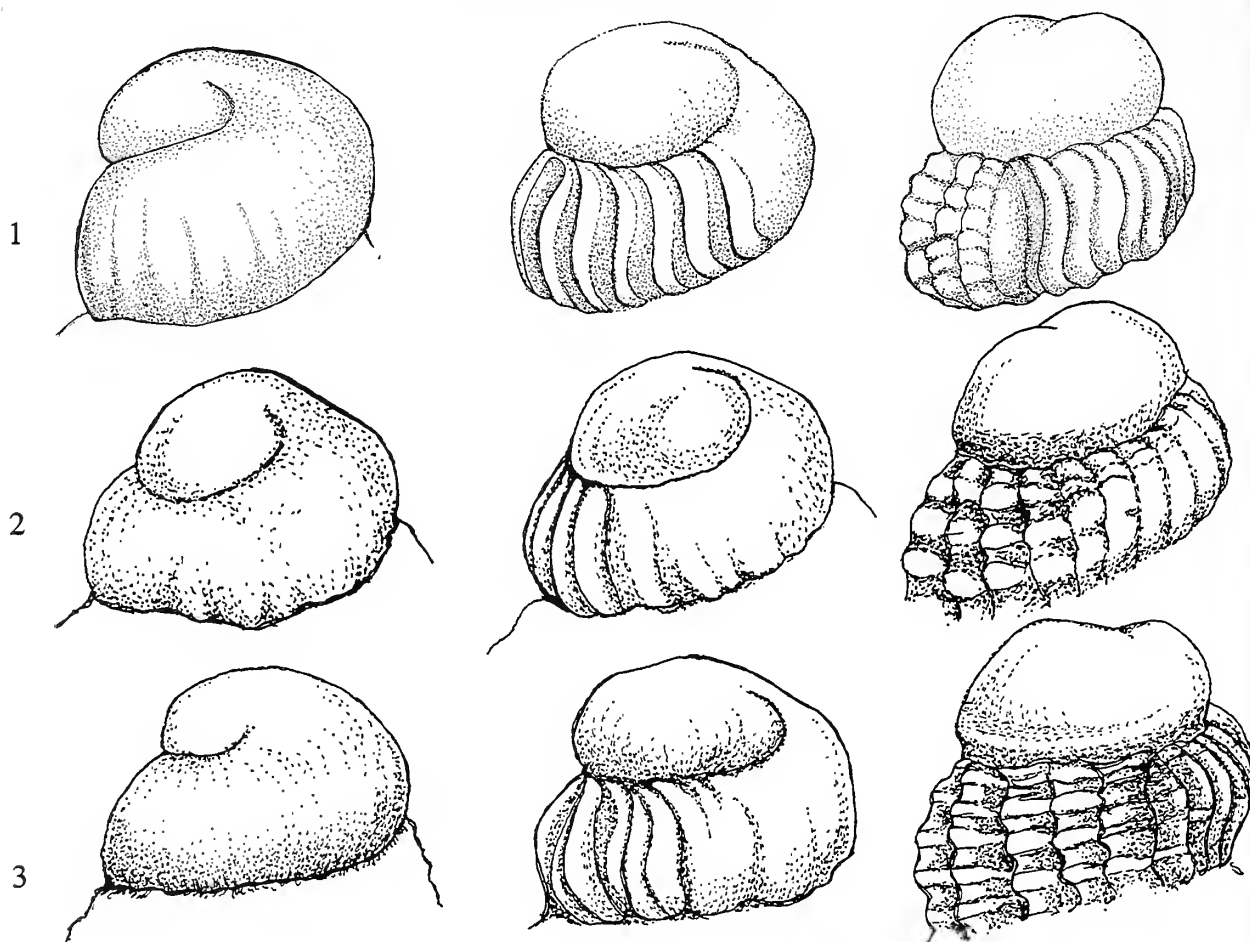
Results and Discussion

Character based analysis: The three nominal species have a protoconch of 1½ rounded whorls with tips immersed (Figures 1-3), a typically large, horny, and unguiculate operculum with a basal nucleus, and a radula having a central tooth with three cusps and a lateral tooth with seven to eight cusps and two endpoints (Poorman, 1981a for *F. consagensis* and preliminary unpublished work of Leroy Poorman now in the SBMNH for *F. fredbakeri*). *Fusinus ambustus* can be separated from the nominal taxa *F. consagensis* and *F. fredbakeri* by the periostracum and the overall shape of the shell. The periostracum of *F. ambustus* (Figure 4) is thin, almost transparent with axial rows of raised hairs, whereas the other two species (Figures 5, 6) have a dense periostracum with crowded axial rows of lamellae with triangulate projections. The shape of *F. ambustus* is elongate with a straight erect shell outline, an acute spire and straight canal, compared to the broad, rounder shape, with canal bent to the left in the nominal taxa *F. consagensis* and *F. fredbakeri*. *Fusinus ambustus* (Figures 7, 8) is undoubtedly a distinct species.

The differences between *F. consagensis* and *F. fredbakeri* based on the above characters proved to be more difficult. First, the original descriptions and the type specimens showed some discrepancies. *Fusinus fredbakeri* was described as an intertidal species of six teleoconch whorls, attaining a length of 38 mm with a diameter of 15.5 mm. Our measurement of the holotype is 39.0 x 16.7 mm. The canal was said to be "straight, narrow and of medium length ... aperture broadly rounded" (Lowe, 1935: 25) and broader than *F. ambustus*. *Fusinus consagensis* was described as a deep-water species, attaining a length of 68.7 mm with a diameter of 23.4 mm (holotype), canal "long narrowly open to the right, bent strongly to the left" (Poorman, 1981a: 339), aperture ovate. Second, study of the type lots of both species showed the shells to be variable within species. The canal appears

Table 1. Type Specimens and Comparative Material of Nominal Species
Fusinus fredbakeri & *F. consagensis* from San Felipe
 in Institutional and Private Collections

Collection	Data
Type material	
SDNHM	holotype (27.88 mm) and 23 paratypes 17.8-39.1 mm (<i>Fusinus fredbakeri</i>), San Felipe, Baja California, México
LACM	holotype (68.7 mm) (<i>Fusinus consagensis</i>), off Consag Rock, Gulf of California, México
SBMNH	13 paratypes 34.0-70.8 mm (<i>Fusinus consagensis</i>), same as holotype
AMNH	37 paratypes 38.6-63.1 mm (<i>Fusinus consagensis</i>), same as holotype
CSC	1 paratype 36.1 mm (<i>Fusinus consagensis</i>), same as holotype
Comparative material	
GC	176 spec., 14.6-67.7 mm, San Felipe, Baja California, México
HC	7 spec., 27.4-64.5 mm, S of Pta. San Felipe (Rudy's), -6.0' tide, 7 am, 3 July 1970 9 spec., 42.1-76.8 mm, S side of Pta. San Felipe, (Rudy's) among rocks at low tide, spawning, 15 March 1968, det. R. Poorman as <i>consagensis</i> 3 spec., 41.9-52.2 mm, Ensenada Blanca, N side of Pta. San Felipe, -4.0' tide, 8 pm, 31 December 1967 40 spec., 25.7-77.2 mm, S side of Pta. San Felipe (Rudy's), among rocks, low tide, 15 March 1968 4 spec., 23.5-31.7 mm, Ensenada Blanca, N side of Pta. San Felipe, 20 April 1975 1 spec., 61.1 mm, Pta. San Felipe, -4.0', 7 pm, in wet sand, 30 December 1967 23 spec., 18.7-41.3 mm, S side of Pta San Felipe (Rudy's 2), 3 May 1969 38 spec., 22.8-68.0 mm, San Felipe, 26-28 February 1971 6 spec., 37.7-68.3 mm, Ensenada Blanca, N side of Pta. San Felipe, -4.0' tide, 8 pm, 31 December 1967 3 spec., 20.1-31.5 mm, S side of Pta San Felipe (Rudy's), -4.0' tide, 7 pm, on wet sand, 30 December 1967 1 spec., 37.5 mm, San Felipe, 10 May 1971 10 spec., 19.1-22.2 mm, N of Ensenada Blanca, 27 April 1975 1 spec., 33.7 mm, Ensenada Blanca, N. side of Pta. San Felipe, 8 pm, 12 November 1966 1 spec., 29.0 mm, Ensenada Blanca, N side of Pta. San Felipe, 26 April 1982 8 spec., 31.5-43.5 mm, S side of Pta. San Felipe, among rocks, low tide, spawning, 15 March 1968 12 spec., 17.1-40.1 mm, S side of Pta. San Felipe (Rudy's 2), -4.0' tide, 7:30 am, among small rocks, 18 March 1969 3 spec., 24.8-61.7 mm, Pta. San Felipe, among rocks, 24 April 1982
DSC	6 spec., 18.7-25.6 mm, off Pta. San Felipe in 5-7 fm, leg. D. R. Shasky, 27-29 March 1959
CSC	7 spec., 28.5-59.5 mm, Campo Uno, S. of Pta. San Felipe, -4.0' tide, in mud between rocks, intertidal, leg. C. Skoglund, March 1976, det. R. Poorman as <i>consagensis</i>
MC	7 spec., 10.5-31.1 mm, Playa Alicia, San Felipe, -6.0' tide, leg. M. Mulliner, 25 April 1975 5 spec., 21.3-44.1 mm, Ensenada Blanca, N side of Pta. San Felipe, leg. D. Mulliner, 29 December 1967 6 spec., 52.7-69.4 mm, Ensenada Blanca, N side of Pta. San Felipe, leg. D. Mulliner, 29 December 1967



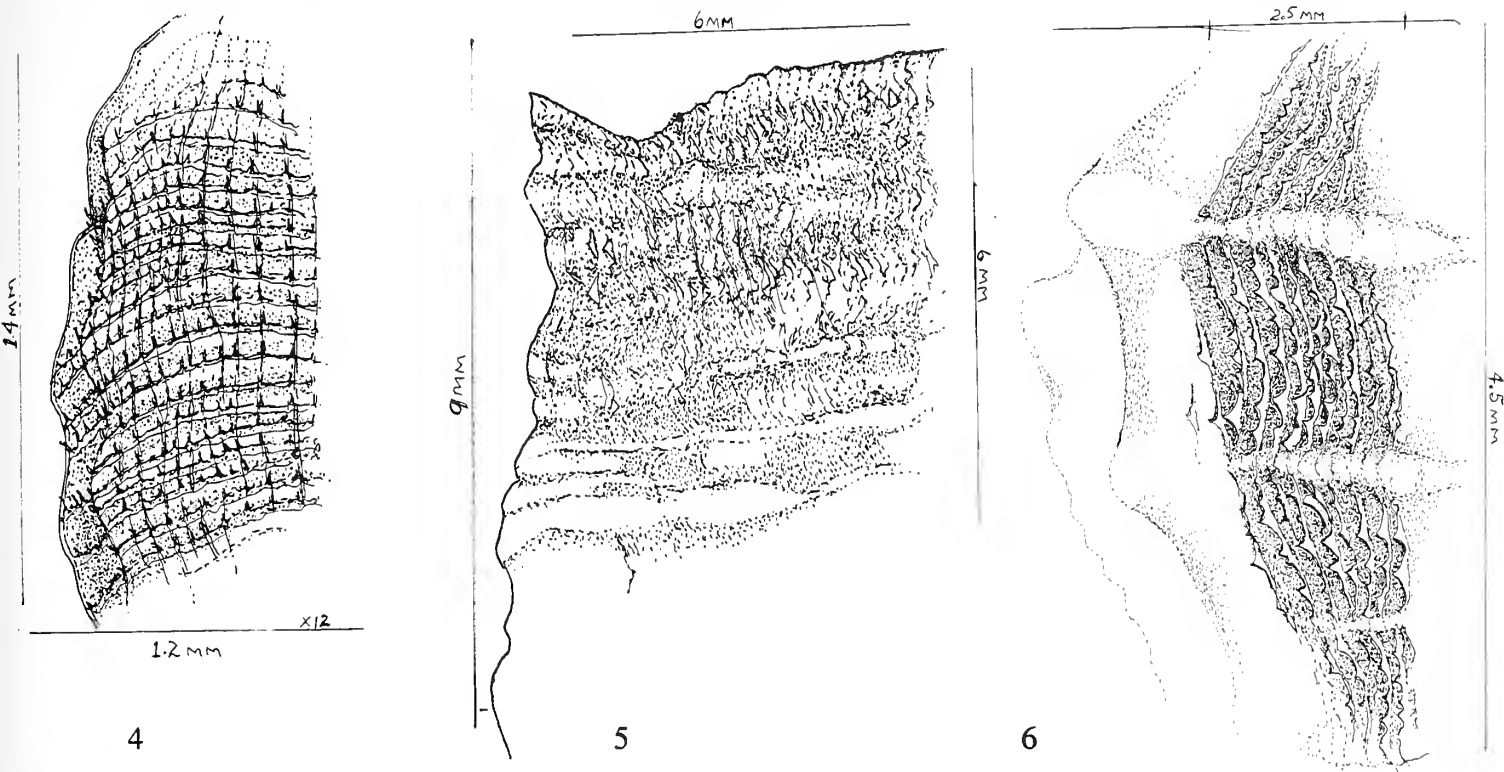
Figures 1-3. Protoconchs of three *Fusinus* species, each in three views (left to right), ventral, $\frac{1}{4}$ turn, dorsal. Drawn by Gemmell with the aid of a camera lucida attachment to a Wild microscope. (1) *Fusinus ambustus* (SBMNH 1396), 31.9 x 10.2 mm, San Carlos, Guaymas, Sonora, México, leg. L. Poorman, December 1971. (2) *Fusinus fredbakeri* (SDNHM 50955, paratype), 28.8 x 11.7 mm, San Felipe, leg. H. N. Lowe, 1932 (3) *Fusinus consagensis* (LACM 1934, holotype), 68.5 x 23.2 mm, dredged in 22 m, 3 km S of Consag Rock, San Felipe, 28 June 1968.

proportionally longer in larger specimens. The canal on the 39 mm holotype of *F. fredbakeri* (after the 6th whorl) is 8.5 mm. The canal of a 39.3 mm paratype of *F. consagensis* (after the 6th whorl) is 11.0 mm (Table 2).

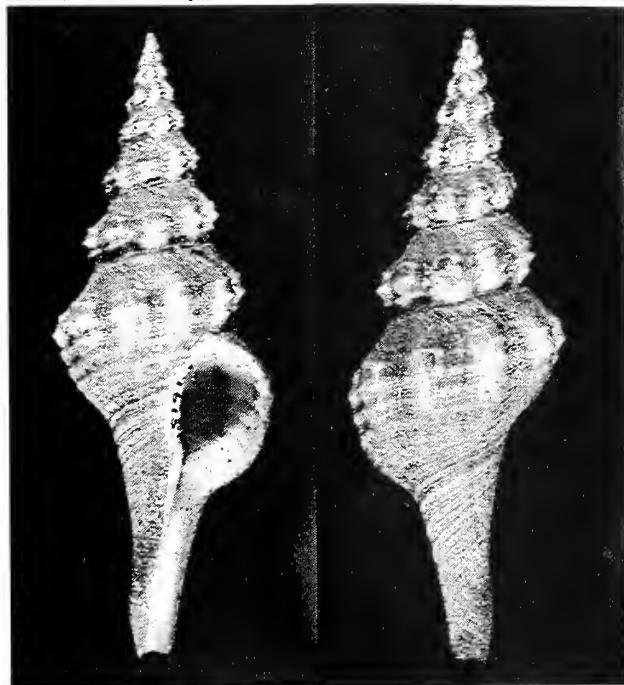
Ecology: Field observations suggest that the two nominal species *F. consagensis* and *F. fredbakeri* are occupying the very same niche and breed together, which raises additional questions about their species status. *Fusinus consagensis* was described as a deep-water species from 20 to 30 meters depth off Consag Rock [31°07'N, 14°30'W], an islet approximately 32 km [20 miles] offshore from Bahía San Felipe. The only intertidal specimens noted by Poorman in his original description were crabbed specimens from San Felipe and Bahía la Cholla, Sonora, on the other side of the Gulf. *Fusinus fredbakeri* was collected by Lowe in the intertidal of San Felipe. In March of 1968, 1970 and 1971 the two nominal species were found together on, under and among rocks with egg masses at Punta San

Felipe and Ensenada Blanca in the north San Felipe area by Gemmell and C.M. & J. Hertz. Hertz (1998) collected specimens of *F. fredbakeri* on eggs in Bahía la Cholla, Sonora, México, and found specimens of up to 51.2 mm in length, the size of *F. consagensis*. Specimens in the size range of both species (Figures 9, 10) were found together under and on rocks, intertidally, with eggs. Gemmell (1973:33-34 as *F. ambustus*) noted that large adults were found at night spawning in the intertidal area during low tides of approximately 1.5-1.8 m (5-6 ft) below mean low tide. She described "communal egg deposition ... by hundreds of [*Fusinus*] snails 40 to 65 millimeters in length, on stones, in a muddy channel. One month later ... the breeding snails were gone and some of the egg capsules were empty."

Morphometrics: Can the two nominal species *F. consagensis* and *F. fredbakeri* be distinguished using shell morphometrics? Is *F. fredbakeri* a short stubby



Figures 4-6. Periostracum in three species of *Fusinus*. Drawn by Gemmell from a small area of the body whorl with the aid of a camera lucida attachment. (4) *Fusinus ambustus* (BMC) [drawn behind the aperture on lip edge], 42.5 x 15.5 mm, Bahía Concepción, Golfo de California, leg. B. W. Myers, December 1977. (5) *Fusinus fredbakeri* (SDNHM 50955, paratype), 28.8 x 12.1 mm [drawn behind the aperture of the body whorl]. (6) *Fusinus consagensis*, (AMNH 221949, paratype), 49.5 x 19.8 mm, dredged in 22 m, 3 km S of Consag Rock, San Felipe, 28 June 1968 [drawn on body whorl behind the columella].



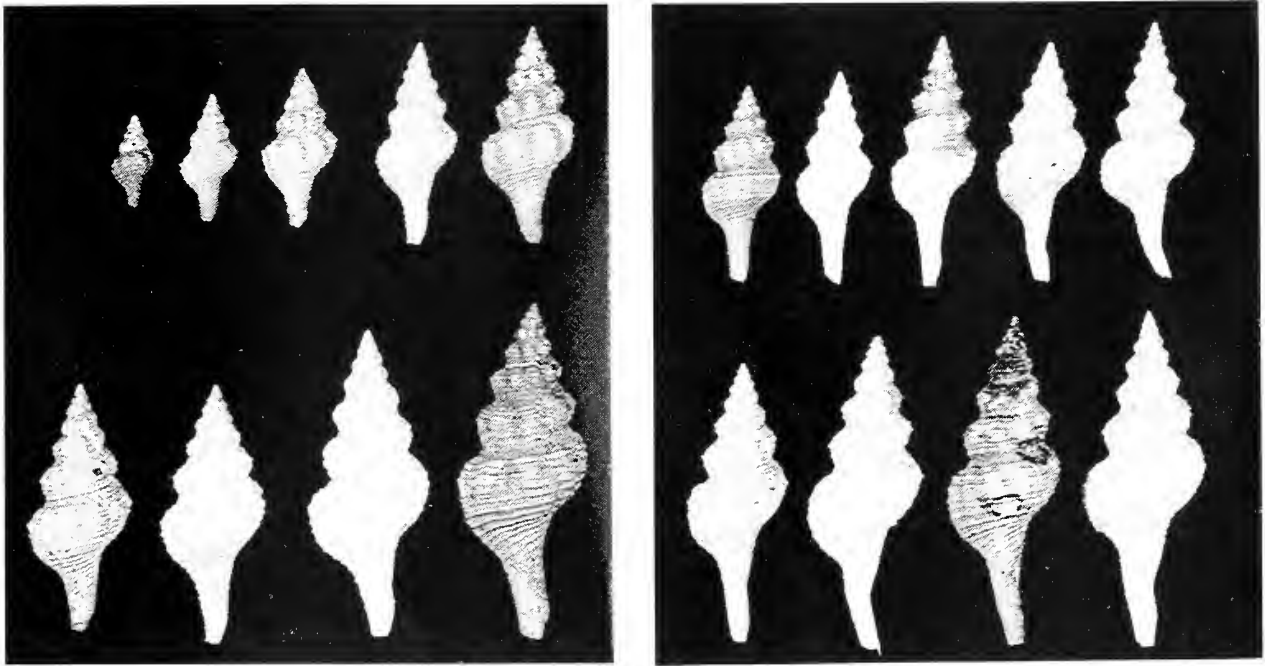
Figures 7, 8. *Fusinus ambustus* (SDNHM 19615), (7) apertural and (8) dorsal views, 57.3 mm, La Paz, Baja California Sur, leg. H. N. Lowe, February 1929. Photos: D. K. Mulliner.

species with a short canal, and is *F. consagensis* a large species with a long canal? To this end some shell measurements were statistically analyzed. All ratio variables were not significantly different from the normal distribution. A k-means cluster analysis using all three ratio variables designed to recover two groups found one group with 115 *consagensis* and 16 *fredbakeri* and the other with 8 *consagensis* and 194 *fredbakeri*. X^2 -tests, testing against a 50%-50% distribution proportional to the number of specimens available for each nominal taxon, were highly significant at $p < 10^{-4}$. Including the 12 specimens of questionable identity to the analysis distributed them proportionally between the two recovered groups ($X^2 p = 0.68$). One way ANOVAs for each of the variables between the groups recovered by the cluster analysis were also significant at $p < 10^{-6}$. A discriminant function analysis using the three ratio variables classified 90.24% of the *consagensis* and 95.71% of the *fredbakeri* correctly. However, 28% of the *consagensis* specimens and 13% of the *fredbakeri* specimens had posterior probabilities of < 0.95 . The factor loadings (Table 3) show that L/W contrasts with the two ratios

Table 2. A Comparison of *Fusinus fredbakeri*, *F. consagensis* and *F. ambustus* from Examination of Type Material and the Original Descriptions

[H = holotype. Entries in quotation marks and /or not highlighted are from the original description. Our findings are highlighted.]

Parameter	<i>Fusinus fredbakeri</i>	<i>Fusinus consagensis</i>	<i>Fusinus ambustus</i>
Max. length	39.1 mm (H)	70.8 mm (H)	61.2 mm (H)
Max. diameter	16.7 mm (H)	25.3 mm (H)	18.4 mm (H)
Protoconch	1½ rounded whorls, tip immersed, vertical ribs on last ¼ turn	"blunt, of 1½ turns with the tip immersed and with fine axial riblets on the last ½ turn"	1½ rounded whorls, tip immersed, vertical ribs on last ¼ turn
Periostracum	tan, dense, triangulate projections on lamellae as they go over axial cords	"thin, nonfibrous"	light tan, thin, almost transparent, with axial rows of raised hairs
Shape	"In all stages of growth this shell is much broader than <i>F. ambustus</i> ... well-rounded, strongly sculptured whorls"	"fusiform ... angulate outline of the whorls ... largest diameter in the middle"	"spire acute ... convex somewhat angulate whorls" fusiform, elongate
No. of teleoconch whorls	"six"	eight	"eight"
Axial sculpture	"twelve rounded ribs [on penultimate whorl] with about equal interspaces most prominent on the periphery" 9 ribs on 6 th whorl	[on early whorls] "about 10 strong, low, rounded axial ribs, interspaces narrow" [on body whorl] "axial ribs and peripheral cords weak, obsolete on the gerontic stage"	"about eight varicose folds on each whorl disappearing on the last half of the anterior whorl"
Spiral sculpture	10-11 rounded axials with narrow interspaces	"By the 5th whorl, upper cord dominant and outline of whorls angulate, slightly convex above and below marked by about 5 spiral threads"	"girdled with elevated threads"
Suture	"eight or nine spiral cords of unequal strength on the penultimate whorl"	on 6 th teleoconch whorl, 11 spiral cords of unequal strength, peripheral cord a keel	"suture deep, to which the upper part of each whorl gradually slopes"
Body whorl	well defined	"below the suture, a shallow sulcus extends all the way to the aperture"	"varicose folds on each whorl disappearing on the last half of the anterior whorl"
Aperture	large with weak ribs; constricted around base	in the outer lip "disproportionately large body whorl"	body whorl proportional to rest of shell
Canal	"broadly rounded, outer lip thin, crenulated by the spiral sculpture ... shows through on the inside." heavy callus on columella	[ovate] "white ... outer lip thin, flaring, numerous weak lirations within ... columellar callus thin, underlying cords visible; opposite a heavy callus deposit on the columella" "pinched-in outer lip at the lower part of the aperture"	"quite small, nearly semicircular, furrowed within" columellar callus thin in <i>herleini</i> , <i>albescens</i> and <i>bruneotincta</i>
Color	"straight, narrow and of medium length" distal flexure, tip bent to left, canal on 6 th whorl: (H) 8.5 mm, total shell length: 39.1 mm	"long, narrowly open to the right, bent strongly to the left, terminating with a distal flexure."	"beak nearly straight ... with a narrow channel" distal flexure at anterior end
Radula	"deep cream color, [H] on other specimens shaded to a warm sienna brown"	"tan with brown maculations between the ribs" on holotype only faint hint of brown on cream colored shell.	"yellowish, shaded with brown so as to appear as if scorched"
	central tooth with 3 cusps and laterals with 7 cusps and 2 endpoints (Poorman, unpublished)	central tooth with 3 cusps and laterals with 8 cusps and 2 endpoints (Poorman, 1981a)	central tooth with 3 cusps and laterals with 7 cusps and 2 endpoints (Poorman, unpublished)



Figures 9, 10. (9, left) *Fusinus fredbakeri* (GC), growth series of nine live-collected specimens 14.4-52.3 mm, San Felipe. (10, right) *Fusinus consagensis* (GC), growth series of nine live-collected specimens 48.7-61.7 mm, San Felipe. Photos: D. K. Mulliner.

involving the canal length (C/L, C/W) (Figure 11: lower case variable names).

One way ANOVAs of the size independent variables were highly significant (Table 3) although the F-values were smaller than those from the groups recovered by the cluster analysis. In order to remove the effect of the absolute size on shell shape as shown in Figure 12, L, W, and C were designated as co-variables. The F-values in these ANCOVAs dropped sharply, but still left the F-value for each variable significant (Table 3). This indicates that a large amount of the differences between the two nominal taxa is due to size alone. Or put in another way, the value of the size independent ratio variables are strongly dependent upon the actual size of the specimen, an indication of allometric change of shape within each of the nominal taxa. Combining all variables in single analyses with and without co-variables had similar effects: MANOVA: Wilk's Lambda = 0.297 Rao's R = 259.4, df 3, 329 $p < 10^{-6}$; MANCOVA Wilk's Lambda = 0.959 Rao's R = 4.604, df 3, 326 $p = 3.59 \times 10^{-3}$.

Although the two nominal taxa can be shown to differ significantly from one another, the available data do not provide guaranteed means to identify any given

specimen. Six and eight percent of the specimens were mis-classified in the discriminant function analysis, and up to 35% of the specimens had posterior probabilities of less than 95%. Similarly, from the comparison of ANOVAs and ANCOVAs it can be clearly seen that the size of the specimens has a strong influence on the value of the shape variables. It remains to be explained why the (M)ANCOVAs were significant. One possible cause may be due to non-random sampling of the specimens at hand. Collectors may only collect specimens which are typical, i.e., correspond to a preconceived notion of the existence of two separate species. Intermediate specimens are left in the field. This suspicion is confirmed by the proportional allocation of unidentified specimens to either of the groups in the cluster analysis. **Comparisons to other species:** The species in question can be distinguished from similar ones in the region as follows. *Fusinus colpoicus* has a bulbous protoconch of $1\frac{1}{3}$ whorls, sculpture of sharp spiral cords, and resembles the Californian *F. barbarensis* (Trask, 1855). *Fusinus irregularis*, a larger species has a very large 2^{+} -whorled, white protoconch, strong sloping teleoconch whorls with pronounced peripheral keel, no varices on the final three whorls, and a long sinuous canal.

Table 3. Comparison of ANOVA and ANCOVA (co-variates L, W, C) F and p-values for each of the three ratio variables. Note sharp drop in F and p-values when co-variates are taken into account, indicating strong size dependency of the ratio values. The third column gives the factor loadings for the first root found in the discriminant function analysis accounting for 87% of the variance.

Variable	ANOVA $F_{(1, 331)}$	ANCOVA $F_{(1, 328)}$	Factor loading
L/W	655 $p < 10^{-6}$	11.7 $p = 7 \times 10^{-4}$	-0.894
C/L	219 $p < 10^{-6}$	5.2 $p = 2 \times 10^{-2}$	0.898
C/W	630 $p < 10^{-6}$	12.3 $p = 5 \times 10^{-4}$	0.998

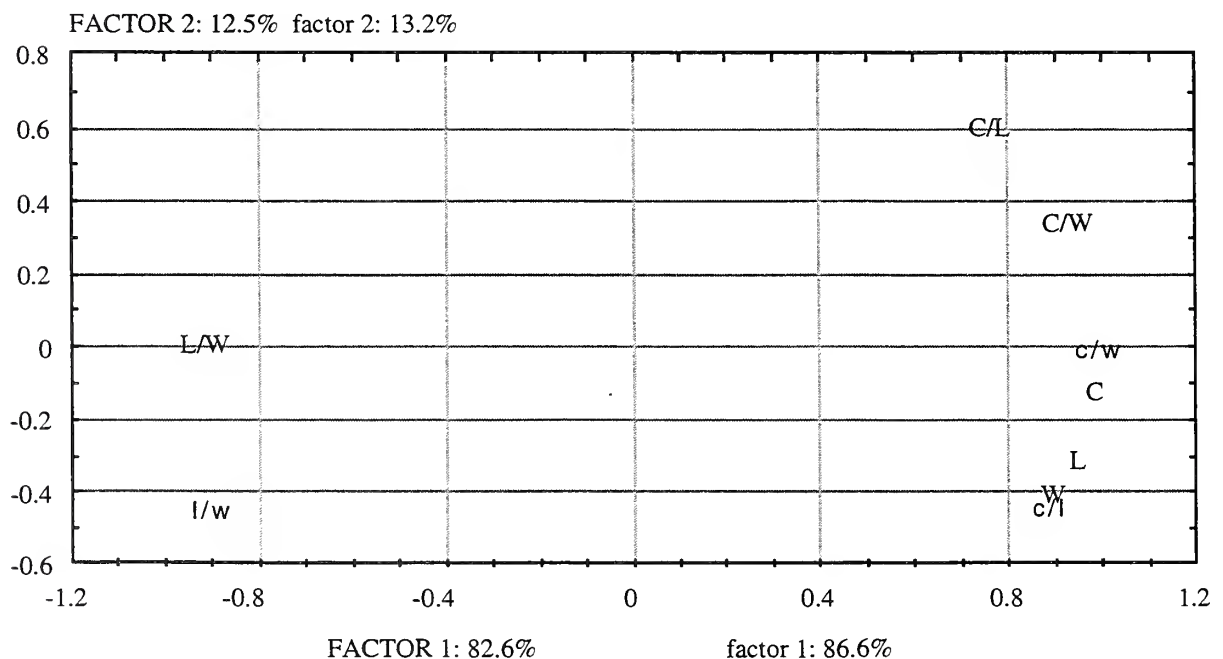


Figure 11. Scatter plot of the factor loadings of first and second root. Lower case labels of axes and variables identify the analysis with the three size independent variables only. Labels of axes and variables in all caps refer to an analysis with all six variables. Note the strong signal in L/W as compared to the remainder of the variables in both cases.

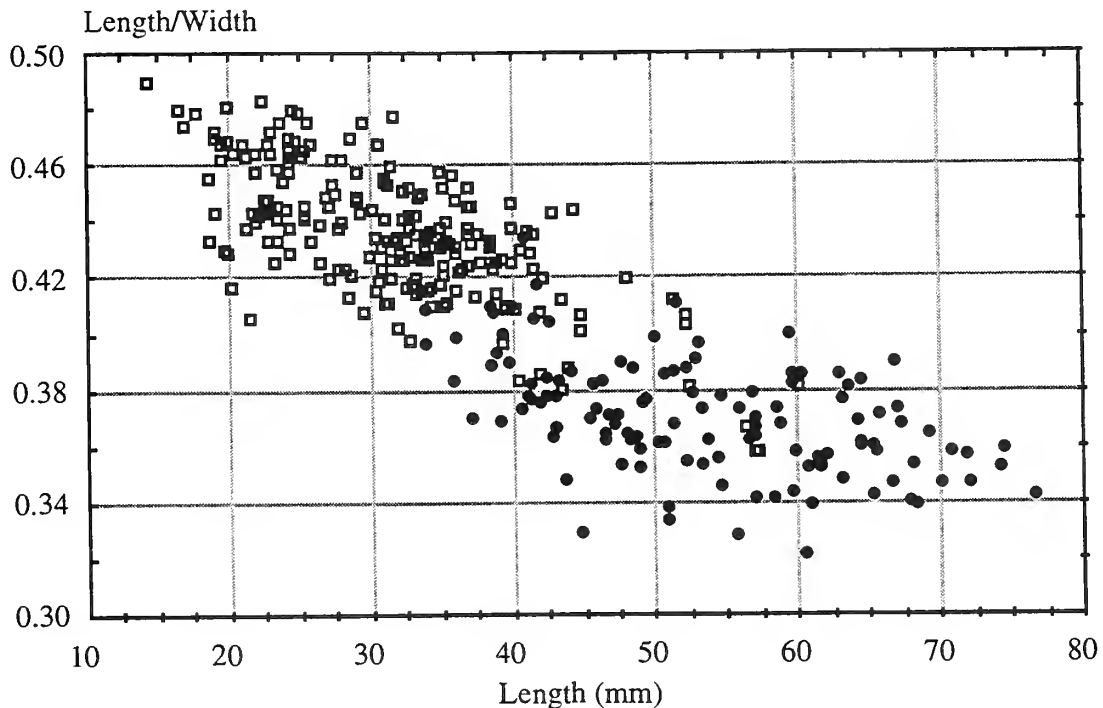


Figure 12. Scatter plot of L against L/W. Open squares: *F. fredbakeri*. Closed circles: *F. consagensis*. Note the allometric change in shape in either of the taxa, and the continuous trend over both nominal taxa.

Fusinus panamensis is a much larger, heavy, more robust species attaining a length of 150 mm (Keen, 1971) with a proportionally shorter, broadly open canal. *Fusinus allyni* with three nuclear whorls, is a larger species of nine rounded teleoconch whorls, has a thinner shell and a more inflated body whorl and is restricted to the Galápagos and Isla del Coco. Juvenile and dead adult specimens of *F. dupetitthouarsi* with its four-whorled protoconch have been found in San Felipe. Living specimens have rarely been found there; Gemmell collected only one in eleven years and attributes the uncommon occurrences to introduction by shrimp boats. *Fusinus turris*, resembling *F. dupetitthouarsi* but with a protoconch of $1\frac{1}{2}$ turns, has not been seen in San Felipe, and was reevaluated by Poorman (1981b). *Fusinus felipensis* Lowe, 1935, is a small, dark-colored species with red animal, and *F. cinereus* (Reeve, 1847) is another dark-colored species. All of the aforementioned differ from the three species in question (Table 2).

Conclusion: We have tried to the best of our abilities to find any discriminating characters between the two

nominal taxa *F. consagensis* and *F. fredbakeri*. Neither the shell morphological characters (protoconch and teleoconch morphology, periostracum, operculum, radula) nor the statistical approach provide sufficient grounds to confirm that these two taxa represent separate species. Additional anecdotal evidence on their microsympatry and their reproductive behavior cast further doubt on their species status. Accordingly, we synonymize *F. consagensis* under *F. fredbakeri* applying the rule of priority.

Acknowledgments: Many individuals and institutions were helpful in our study. Paula Mikkelsen and William K. Emerson (AMNH), Lindsey T. Groves and James H. McLean (LACM), Henry W. Chaney (SBMNH), and Sally Shelton (then of the SDNHM) lent type material. Margaret and David K. Mulliner, Donald R. Shasky, and Carol Skoglund lent comparative material. Jules Hertz, Michael Hollmann, Bob Petroski, and the late Paul Skoglund gave inputs for preliminary statistical analysis. James H. McLean reviewed a draft of the paper and made many helpful suggestions. David K. Mulliner did all the photography

and the SDNHM made their facilities available to us. Our gratitude to them all.

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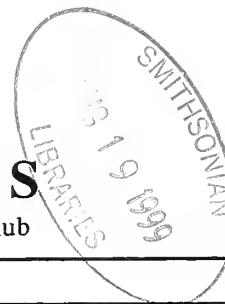
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THE FESTIVUS

A publication of the San Diego Shell Club



ISSN 0738-9388

Volume: XXXI

August 12, 1999

Number: 8

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Membership (includes family). Domestic \$15.00;
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Address all correspondence to the San Diego Shell Club, Inc.,
c/o 3883 Mt. Blackburn Ave., San Diego, CA 92111, USA.

The *Festivus* is published monthly except December.
The publication date appears on the masthead above.
Single copies of this issue: \$5.00 plus postage.

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Meeting date: third Thursday, 7:30 PM,
Room 104, Casa Del Prado, Balboa Park, San Diego

PROGRAM

The Oldest Cretaceous Marine Fossils in San Diego County -- and How We Know It

George Kennedy, adjunct professor at San Diego State University, paleontological consultant, and San Diego Shell Club member, will give a slide program and

discussion on how a simple discovery of a rocky shore marine fauna in Carlsbad led to solving a scientific puzzle.

Meeting date: 19 August 1999
Shells of the month: southern California fossil mollusks

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CLUB NEWS

Minutes of the San Diego Shell Club Meeting - 15 July 1999

President Terry Arnold opened the meeting at 7:45 p.m. by welcoming everyone. Approximately 23 members were in attendance. The minutes were approved as published in *The Festivus*. Terry reminded everyone that the September Party will be at his house and that the potluck will include a variety of hors d'oeuvres. The Christmas Party will be on December 4th.

Terry mentioned that there will be a new feature at meetings. Occasionally members may make short presentations (for about five minutes). These presentations may be about travels to share information on recent developments in various areas around the world or other matters of interest to members.

Kim Hutsell discussed the 1999 COA meeting in Kentucky. He said it was a great meeting with good attendance. He reported that other clubs around the country are struggling with the same issues as our club. One of the activities of these clubs is that they are donating shells to local schools to encourage the interest of young people in shells and marine life.

Terry then spoke about the current status of collecting fossil mollusks in Australia. He said there are still good places to go but it takes some investigation of weather conditions at specific locations.

Mike Mason introduced the speaker for the evening, our own Kim Hutsell. With the room set up for an informal discussion, Kim shared some of his insights into the best procedures for cleaning the animal from the shells and caring for the shell itself. Kim began by emphasizing that, when collecting, you should determine whether or not each specimen is worth keeping. If you will not be willing to clean the shell to keep it as a specimen, return it to the water immediately. Kim suggested using a water pressure hose to remove the animal. Always remember to save the operculum of the animal. Kim had samples of attachment tools he had made to get into shells with long siphonal canals. He also said dental tools can be purchased at swap meets for removing remaining parts of the animal and for cleaning the exterior of the shell. Kim recommended using bleach to soak and clean the shell itself (provided you do not want to retain the

periostracum), though there are a number of other chemicals that can be used. Never use bleach on shells with a pearly surface such as abalone. An interesting note is that bleach is more powerful diluted in water than used straight. An engraving tool and/or a Dremel tool can be used for the spots that are difficult to remove otherwise. A variety of oils can be used to coat the surface of the cleaned shell. These include mineral oil or glycerin. Kim said that silicone oil produced by Dow-Corning is the best but it is also costly. He applies it with a small paintbrush. A product called Iron Out is effective at removing the rust stains found on some shells.

There were many questions asked and ideas put forward by the audience. It was a program enjoyed by all.

The winner of the door prize was Jules Hertz. The meeting was adjourned to check out the tools brought in by Kim and to enjoy the refreshments contributed by Kay Klaus.

Silvana Vollero

The September Party

It's a grazing party!! The garden party with "heavy" hors d'oeuvres will be held on Saturday evening September 11th beginning at 6 p.m. Marty and Terry Arnold have again graciously offered their home and garden for the event. There will be a sign-up sheet and further details at the August meeting.

New Member

Deems, Ron, 1768 Hermes, San Diego, CA 92154-2814, (610) 424-3750

IN MEMORIAM

Virginia "Ginny" Upton

1931-1999

SOME NOTES ABOUT RANGE, HABITAT AND ECOLOGY OF THE MEDITERRANEAN SPECIES OF CYPRAEIDAE

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Although the Mediterranean is the most studied of the seas and Cypraeidae is a very popular family among collectors and students, many inaccuracies are present on range and habitat of the Mediterranean species of Cypraeidae in the popular guides on cowries. In these works, natural history is treated schematically or commonly neglected. The aim of this contribution is to show some of these points, mainly based on my personal experiences.

Luria lurida (Linnaeus, 1758) (Figures 1-3)

Concerning the range Burgess (1985: 181) wrote: "The labels give the place where the fisherman sold them, not where he found them. I was unable to find any fisherman in any large port in Greece, Italy or southern France who had actually collected this shell in the northern Mediterranean." This is wide of the mark; *L. lurida* is really common in southern Italy. I personally collected this species in abundance in several localities in northern Sardinia, where on only a single dive, a diver can find specimens by tens.

In Italy the species is uncommon only north of latitude 44°, and it is present in all the Mediterranean as far as latitude 45° 45' (Doneddu & Manunza, 1987).

L. lurida is the most northern species in the family.

As regards the habitat and ecology, Burgess mentioned only the depth range of 30-40 feet, under rocks, Walls (1979) did not give any data and Lorenz & Hubert (1993) reported "Under stones and amongst seaweed in 15-45 m." Actually *L. lurida* ranges from 0.2 to 50 m, on rocks, under stones and often in caves. It is active during the night, and it feeds on sponges, especially on *Verongia aerophoba* (Schmidt) (Doneddu

& Manunza, 1995). Mating of *L. lurida* occurs mainly in March, April and May; as observed in an aquarium, females deposit approximately 90 egg capsules, 4 mm long, in crevices or amongst stones as long as twelve weeks after copulation. The female covers the eggs with her foot for two weeks until the eggs hatch (Doneddu & Manunza, 1993). The egg capsules are yellowish-cream at first but always change to brownish-purple or purplish 15 to 20 hours before they hatch (Figures 2, 4). I have had 15 specimens living in my aquarium for over ten years, feeding them on *Verongia aerophoba*, and I have noticed this occurrence at least 30 to 40 times.

L. lurida is heavily preyed upon by *Octopus vulgaris* Cuvier and in an aquarium I observed predatory actions by large crustaceans, such as *Palinurus elephas* (Fabricius), *Scyllarides latus* (Latreille) and by *Murex brandaris* Linnaeus.

Zonaria pyrum (Gmelin, 1791)

Burgess (1985) also doubts the presence along the Italian coast of *Zonaria pyrum*. He states that most specimens come from North Africa or the southern Greek islands. But on the contrary, *Z. pyrum* is present all over the Mediterranean (Doneddu & Manunza, 1988) though it is less common than *L. lurida*. It is found in the Tyrrhenian Sea as far north as latitude 44° (Rebora, 1986) and in the Adriatic Sea as far north as latitude 41° (D'Introno, 1980). I found it in Sardinia both on the western and northern coasts, but it is uncommon there. Probably the habitat in relatively deep water (although it lives also in 8-10 meters, and most specimens are from under 30 meters) hinders the recording of this species. I observed a specimen on eggs in June, and

Federico (1978) reported the same in July. The egg capsules are ovoid in shape, 2-3 mm long, and each contains 32-34 eggs (Lo Bianco, 1899). Curiously, Abbott & Dance (1986) and Lorenz & Hubert (1993) repeated the error of Gray (1824) who translated the Latin name as pear cowrie, but he mistook "pyrum", the Latinization of the Greek πυροζ (that means fire, flame) for the Latin "pirum" (that means pear); the real significance of the Latin name being fire-colored cowrie or red-hot cowrie.

Erosaria spurca (Linnaeus, 1758) (Figure 4)

I record this species from the western and eastern coasts of Sardinia; the specimens from shallow water are dark and small, while the ones in deep water are light and large. This also is reported by Antonio Dimino for specimens at Lampedusa Island (Anonymous, 1986). This species is common in southern Italy.

Schilderia achatidea (Sowerby, 1837)

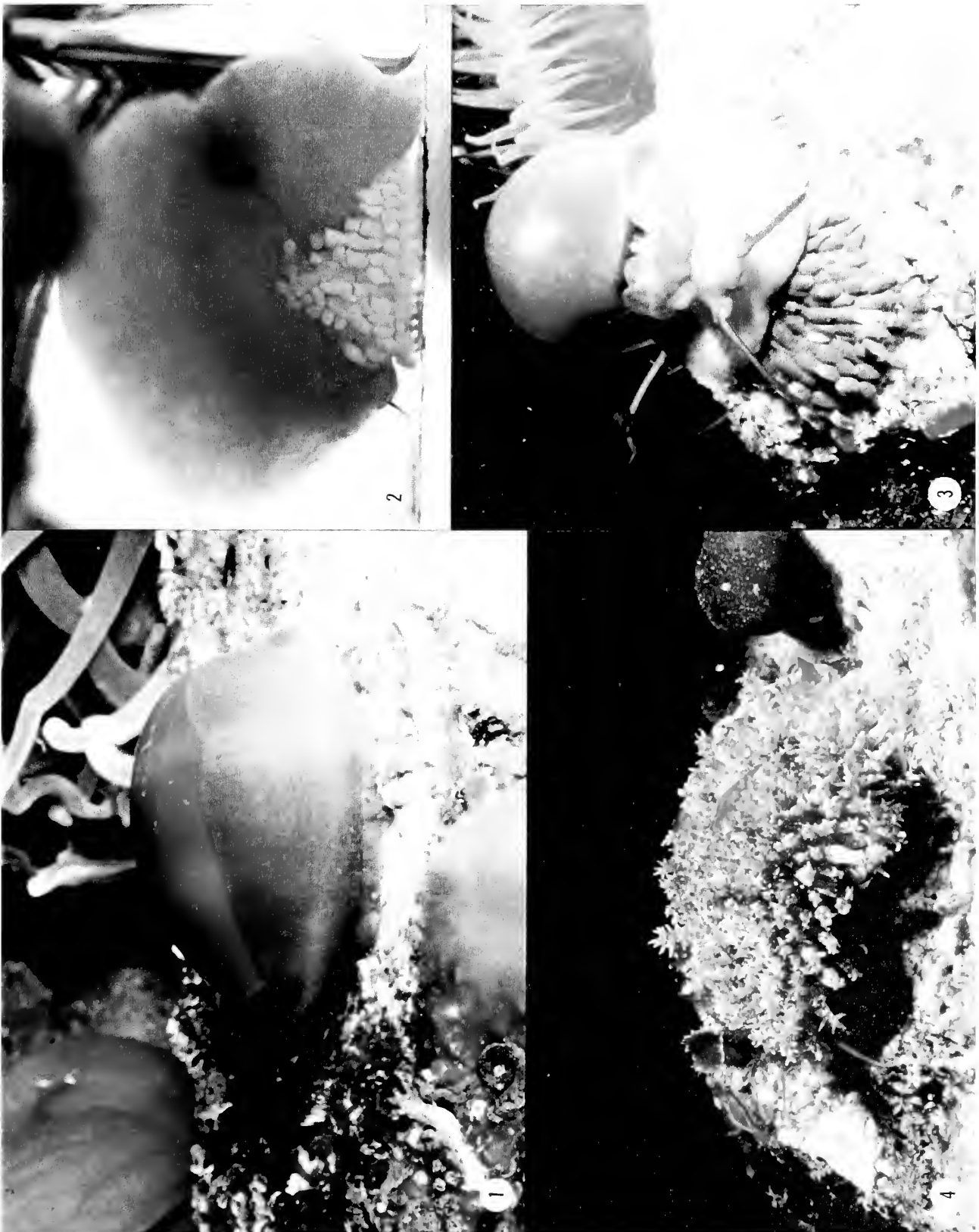
Walls (1979: 191) wrote generally "Mediterranean to West Africa" about the distribution of this species. Burgess reported *S. achatidea* only from the western part of the Mediterranean, and Lorenz & Hubert's Guide shows the same distribution on their map. I never found *S. achatidea* in Sardinia, and I don't know of any records for the island. However, the species is recorded from many localities throughout the Mediterranean. Settepassi (1971) reported all the Mediterranean findings before 1971: Morocco, Algeria, Southern Spain, Provence, Corsica, Tuscany, Latium, Campania, Calabria, Sicily, Lampedusa, Pantelleria, Stromboli and the Aegean. After 1971 there were several findings in the Northern and Central Mediterranean: the species was collected by Luciano Barberini of Rome in October 1984 from Latium, and by Pino Panebianco in 1979 from Liguria (Martinez, 1984). It was also reported from Liguria seven years later (Rebora, 1986). Robert Murth of Vienna found two specimens on the coast of Istria, Northern Adriatic Sea (Anonymous, 1987). It has been found also in Tuscany (Terreni, 1981; Bertozzi *et al.*, 1984), and in Sicily (Mannucci *et al.*, 1983). To sum up, the species is rare everywhere, but it is widely distributed through the western, central and northern Mediterranean (Doneddu & Manunza, 1989).

I wish to thank Carole Hertz, San Diego, California, in providing technical advice and a critical reading of the manuscript and Bruno Manunza, Sassari, Italy, for his companionship and aid during the dives.

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ACKNOWLEDGMENTS



Figures 1-4. (1) *Lurida lurida* (Linnaeus, 1758) with shell partly covered by mantle. (2) *L. lurida* on aquarium wall on cream-colored egg capsules. (3) *L. lurida* on purplish egg capsules 15-20 hours before hatching. (4) *Erosaria spurca* (Linnaeus, 1758) with shell completely covered by mantle.

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BOOK NEWS

A Field Guide to Marine Molluscs of Galápagos.

By: Cleveland P. Hickman, Jr. and Yves Finet, 1999.

ix + 150 pp.; ISBN 0-9664932-2-2.

Price: \$18.95 plus \$3.00 shipping

[from Sugar Spring Press, 802 Sunset Drive, Lexington, VA 24450, USA, (540) 463-4094].

Also available: *A Field Guide to Sea Stars and other Echinoderms of Galápagos.*

By: Cleveland P. Hickman, Jr. 1998. vii + 83 pp. ISBN 0-9664932-0-6.

Price: \$16.95 [same publisher].

These two spiral-bound books provide color illustrations of the common marine mollusks and echinoderms of the Galápagos Islands. In the mollusk book, 256 species are treated, including 56 bivalves, 196 gastropods and 4 chitons. All were photographed by the authors, except for the nudibranchs and other opisthobranchs, for which photographs were provided by Paul Humann and Terry Gosliner. Two or three species per page are treated, with the illustrations adjacent to the text.

The illustrations will certainly make identification of the treated species a simple matter. It is noted in the preface that some 800 species of mollusks are known from the islands. Citations of the more complete recent efforts to inventory the fauna, particularly by Y. Finet and K. Kaiser, are included under selected references.

The book is promoted as useful to "divers, snorkelers, scientists, and other visitors to Galápagos who want to identify the molluscs they see." Not

mentioned is the fact that collecting permits are required to take specimens from the Galápagos and that there are no sources available to those who may wish to purchase specimens for their collections.

Carol Skoglund has noted that the illustration of *Chama frondosa*, seems instead to be *C. buddiana*, and Kirstie Kaiser has noted that the illustration for *Fusinus allyni* is instead the angulate form of *F. dupetithouarsi*.

In the earlier published book on echinoderms, fewer species are treated (I counted 62), but the color illustrations make the book useful elsewhere in the tropical eastern Pacific because very few of the treated species are limited to the Galápagos Islands. An introduction to the echinoderm literature is included. Hickman is now at work on a similar book on the crustaceans of the Galápagos.

James H. McLean,

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REPORT OF 1999 WSM MEETING

JULES HERTZ¹

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Santa Barbara, California 93105, USA

The 32nd Annual Meeting of the Western Society of Malacologists (WSM) was held on 13-16 June 1999 at California State University, Fullerton. There were 58 attendees during the four-day meeting, and they were treated to some excellent symposia, friendly social events, poster presentations, and a great field trip. Host for the meeting was WSM President, Roger Seapy.

Registration for the meeting was at the Marriott Hotel on Sunday, June 13. This was followed by the Executive Board Meeting and Opening Reception. The reception featured a pasta dinner and was a good way of meeting attendees. All symposia were held at California State University, Fullerton.

Monday morning started with a symposium entitled, "Recent Advances in Molluscan Research," organized and chaired by Douglas Eernisse. The topics ranged from fossil polyplacophorans to molluscan research in the next millennium. I was particularly interested in Kaustuv Roy's paper, "Understanding latitudinal diversity patterns in the sea: a molluscan perspective" (Figure 1). He stated that "latitudinal diversity gradients characterize many marine and terrestrial organisms, and are commonly considered to be one of the most fundamental global biodiversity patterns," and he discussed various hypotheses about the controls on such gradients. The afternoon session was a series of contributed papers chaired by Michelle Nishiguchi, covering bivalves and gastropods, DNA sequencing, and opisthobranch biodiversity. A 10-year study of *Cypraea mauritiana* by Alan Miller provided some very interesting insights into *Cypraea* longevity.

On Tuesday morning, there was a Symposium entitled, "Invasive Molluscs: Environmental and Conservation Impacts," organized and chaired by Jonathan Geller. Of particular interest to me was a paper by Dianna Padilla, "Predicting the short-term impacts and spread of the zebra mussel, *Dreissena*



Figure 1. Kaustuv Roy delivering his paper.

polymorpha." She summarized the research on the physiology and ecology of zebra mussels in eastern and western Europe and indicated the success of predicting the spread of the mussels in the United States. She mentioned some of the good the mussels were performing in the cleaning of lakes which is usually not discussed in popular articles on the zebra mussels. In the afternoon, there was a contributed paper session chaired by Robert Cowie. This again contained a mix of diverse papers on bivalves and gastropods. Tuesday evening was the WSM reprint sale and auction, both highly successful. The reprint sale was run by George Kennedy and many found excellent reprints and

¹ Mailing address: 3883 Mt. Blackburn Ave., San Diego, CA 92111, USA.

magazines at very affordable prices (Figure 2).

The auctioneer for the evening was Carole Hertz, who not only succeeded in getting great donations of books and shells for the auction but was also very entertaining and persistent in auctioning the materials. The highlight of the evening was the heated bidding of a book, *Conchylien-Cabinet von Martini und Chemnitz. Oliva* by Weinkauff, 1878, which contained 39 hand-painted plates.

On Wednesday, the entire day was devoted to paleontology. In the morning there was a Symposium, "Current Research on West Coast Molluscan Paleontology," organized by Richard Squires and Lindsey Groves, with Lindsey chairing the session. During the morning break there were three poster presentations, and in the afternoon there was a very successful paleontology field trip to Silverado Canyon. Of particular interest to me was a paper by Carol Stadum and Lou Ella Saul entitled, "Argonauts of the late Miocene, Los Angeles Basin, Southern California." Carol presented the paper and not only showed pictures of the first fossil argonaut finds from the eastern Pacific, but also showed Recent egg cases and the animals that produce them. Her enthusiasm for the subject was contagious and there were many interesting remarks after the formal paper. In the evening, the annual WSM Banquet was held at Angelo's and Vinci's Restaurant, in Fullerton. Although very informal, a good meal and enjoyable evening was had by all. The Student Paper award was won by Mike Vendrasco for his paper, "The earliest recorded polyplacophorans from the Late Cambrian of Utah."

The annual WSM business meeting was held on Tuesday afternoon. The next meeting will be a combined WSM/AMS Meeting to be held in 2000 in San Francisco; in 2001, WSM will hold its annual meeting in San Diego.



Figure 2. At the reprint sale. From left to right: Carole Hertz, Kirstie Kaiser, LouElla Saul and Carol Stadum.

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THE FESTIVUS

A publication of the San Diego Shell Club

ISSN 0738-9388

Volume: XXXI

September 9, 1999

Number: 9

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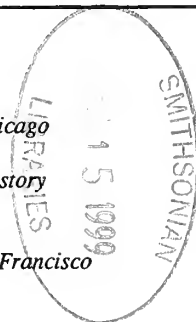
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Membership (includes family). Domestic \$15.00;
Overseas (surface mail): \$18.00, (air mail): \$30.00;
Mexico/ Canada (surface mail): \$18.00, (air mail): \$20.00.
Address all correspondence to the San Diego Shell Club, Inc.,
c/o 3883 Mt. Blackburn Ave., San Diego, CA 92111, USA.

The *Festivus* is published monthly except December.
The publication date appears on the masthead above.
Single copies of this issue: \$5.00 plus postage.

Website at: <http://www.molluscs.net/SanDiegoShellClub/index.html> Email: cmhertz@pacbell.net

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Meeting date: third Thursday, 7:30 PM,
Room 104, Casa Del Prado, Balboa Park, San Diego

PROGRAM

Come to the September Party
(There is no regular meeting this month.)

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CLUB NEWS

Minutes of the San Diego Shell Club Meeting - 19 August 1999

In the absence of President Terry Arnold and Vice President Mike Mason, Jules Hertz called the meeting to order. There were about 24 people in attendance. The minutes of the July meeting were accepted. The sign-up sheet for "munchies" for the September party was passed around and it was announced that the Christmas Party will be on Saturday evening December 4th. The format of the party will be a little different from past years. Instead of slides of member's travels, Dr. Roger Seapy of Cal. State Fullerton will be an invited guest speaker. [See column two.]

Larry Lovell, collection manager of the benthic invertebrate collection at Scripps Institution of Oceanography and new Club member, talked briefly about the reorganization of the collection and the move to a new modern facility. He is interested in several volunteers from the Club to assist with the project, beginning as early as October. There are over 7,000 lots of mollusks to be catalogued. Much research can be done on the material that is there.

Jules then introduced the speaker for the evening, George Kennedy, adjunct professor at SDSU, Club member, and on the review board of *The Festivus*. He discussed the fossils found in an area of Carlsbad. He found a variety of specimens including several new species though most were not in very good condition. He explained that since most were internal molds, they were not suitable for description of new species.

The fossil locality was found almost by accident, a fresh exposure. It was not sure at first if the conglomerate was part of the Point Loma Formation. or the Lusardi Formation. But later study of another site across the road, showed that the conglomerate was not, in fact, from the Lusardi Formation but from the Point Loma Formation. In short, his work revealed something other than what he was looking for initially, but a very exciting discovery.

Before adjourning for treats and socializing, Jules mentioned the available literature on the front tables, and the beautiful displays of fossils brought in by George Kennedy and the Schneiders for everyone to view and enjoy.

The winner of the shell drawing was Carole Hertz and Bill Romer brought in the delicious treats. Linda Hutsell made the motion to adjourn the meeting.

Silvana Vollero

Additions to the Roster

New members

Davila, Rudy, 1185 14th St., Imperial Beach, CA 91932, 619-575-6013

Lovell, Larry, Benthic Invertebrate Collection, SIO/UCSD/Mail Stop 0206, 9600 Gilman Drive, La Jolla, CA 92093-0206

The Club Christmas Party

Mark your calendars for the Christmas dinner party on Saturday evening December 4th. It will again be held in the Montfield Room at the Four Points Hotel where we have previously had such delicious dinners and enjoyable parties.

This year the party will be a bit different and special. In addition to the regular no host cocktails, dinner with complimentary wine, Master of Ceremonies and installation of officers, and gift exchange, there will be a special guest speaker, Dr. Roger Seapy of California State University, Fullerton, who will give a slide program on a very poorly known and beautiful group of pelagic gastropods, the Atlantidae. It is an experience to see the images of these tiny, unique creatures taken in the deep ocean. Roger is a terrific speaker and you will enjoy his talk and meeting him and his wife.

Remember - save the date!

Correction: Several punctuation errors occurred in the chiton paper by Van Belle (1999) in *The Festivus* (31(6): 69-72), and Richard Van Belle brought these to the attention of the editor. They are as follows:

- p. 70 right col., line 25: place a semicolon between *hyadesi* and Plate to read *hyadesi*; Plate
- line 34: place a semicolon between *laevis* and Montagu to read *laevis*; Montagu
- p. 71 right col., 5th last line: place a semicolon between *janeirensis* and Thiele to read as *janeirensis*; Thiele
- p. 72 left col., line 27, change to (= *Chiton* (*Sclerochiton*) *miles*...)

A POPULATION OF THE BIVALVE *PTERIA STERNA* IN CARLSBAD LAGOON, CALIFORNIA

KENT D. TREGO

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Earlier this year, David Leighton of Carlsbad Aquafarms informed me that the El Niño event of 1998 brought the Panamic pearl oyster *Pteria sterna* (Gould, 1851) north to establish a population in Carlsbad Lagoon. A specimen from Carlsbad Lagoon is shown in Figure 1.

Keen (1971) reported *P. sterna* was found from Baja California to Perú. However, Coan and Scott (1997) reported that *P. sterna* has been collected in southern California in warm water years. Oldroyd (1924) and Morris (1952) reported *P. sterna* from San Diego to Panamá. Olsson (1961) reported it from California to Perú.

Paul Valentich Scott, of the Santa Barbara Museum of Natural History (SBMNH), informed me that 1998 collecting records indicate *P. sterna* was found as far west as Venice Beach (Los Angeles County Museum of Natural History) and as far north as Santa Barbara Island (SBMNH).

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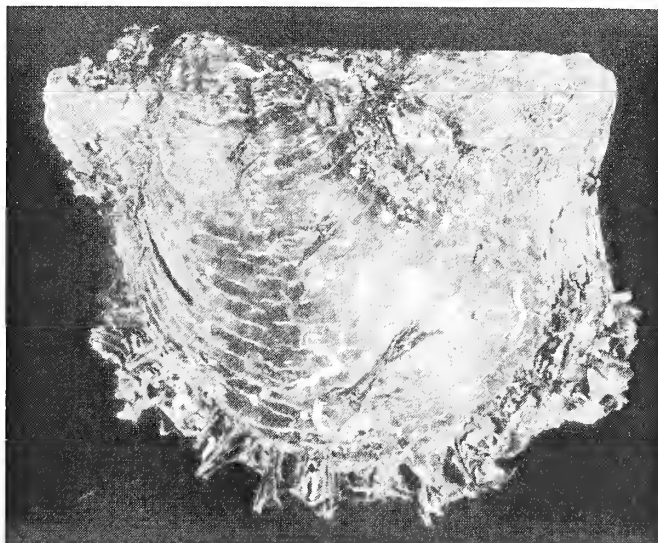


Figure 1. A specimen of *Pteria sterna* from Carlsbad Lagoon, 91 mm L, 72 mm H.

GROWTH SERIES OF COMMON MOLLUSCAN SPECIES (FAMILY: MURICIDAE)

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A frequent dilemma for the avid collector of minute shells is distinguishing the juvenile stages of larger species. In many cases the juveniles of larger species vary dramatically in shape, color and markings from the adults. Typically the protoconchs are worn or missing on mature shells which makes it difficult to make the comparison.

It can be particularly frustrating when identifying material that has been screened and sorted, since the adult specimens have been separated from the juveniles. This can lead to misidentifications and the erroneous naming of new species. Two examples where such problems have been encountered are the juvenile shells of *Turbo fluctuosus* Wood, 1828, and *Norrisia norrisi* (Sowerby, 1838). Juvenile *Turbo fluctuosus* have been mistaken for *Cyclostremiscus* species (Gemmell, Hertz & Myers, 1989). Juvenile *Norrisia norrisi* have a very flattened bicarinate shell with white mottling changing to the very rounded shape of the chestnut brown adult shell (McLean, 1978).

Encouragement by other collectors of micro shells to figure growth series of Panamic species, with the intent of minimizing problems of identification, has given rise to this first paper. Here figured are the growth series of three common rapanid species: *Mancinella triangularis* (Blainville, 1832), *Thais* (*Tribulus*) *planospira* (Lamarck, 1822), and *Thais* (*Vasula*) *melones* (Duclos, 1832).

Figure 1 shows six specimens of *Mancinella triangularis* (Blainville, 1832) in decreasing size: 16.0, 11.1, 7.8, 6.1, 3.4 and 3.2 mm in height. In Figure 2 the 3.2 mm specimen in Figure 1 is enlarged. The difference in appearance between the adult and juvenile specimens is evident.

Figure 3 illustrates eight specimens of *Thais* (*Tribulus*) *planospira* (Lamarck, 1822) in decreasing size: 14.3, 11.3, 6.0, 3.3, 2.4, 1.5, 1.1 and 0.7 mm in

height. Although the largest (14.3 mm) sub-adult resembles a fully mature specimen, an adult specimen attained the size of 70.8 mm (Hutsell *et al.*, 1997). Figure 4 is an enlargement of the 3.3 mm specimen in Figure 3. Note that the definitive dark mark on the columella is not present until the 6.0 mm shell. Again, there is a vast difference between the juvenile and adult specimens.

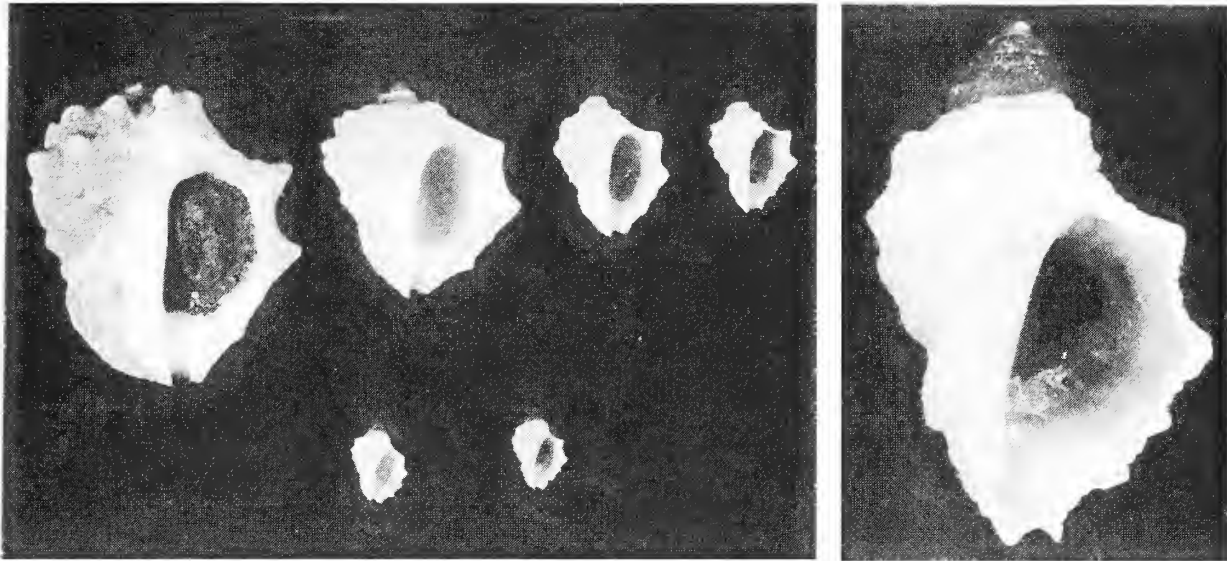
Figure 5 shows seven specimens of *Thais* (*Vasula*) *melones* (Duclos, 1832) in decreasing size: 33.2, 19.3, 13.4, 11.2, 8.9, 6.4 and 4.4 mm in height. Figure 6 is an enlargement of the 4.4 mm specimen in Figure 5. In this series of three rapanids, probably *T. (V.) melones* seems to have the most pronounced difference between the slender, angulate immature shells and the smoothly, rounded adult. In fact, juveniles of all three species look similar in the 3-4 mm range, and without growth series it would be nearly impossible to identify the immature specimens.

Hopefully this paper will encourage other workers to share this type of information so that collectors may be informed and possibly spared the frustration of trying to determine the juvenile of a much larger species.

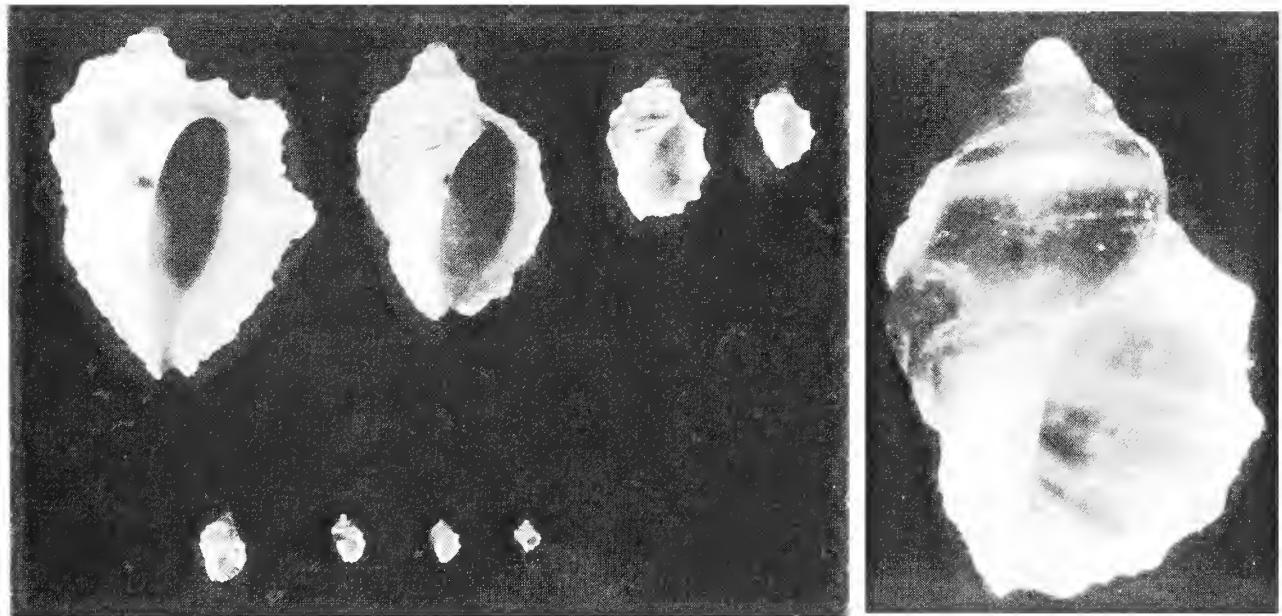
My gratitude to David K. Mulliner for the fine photography.

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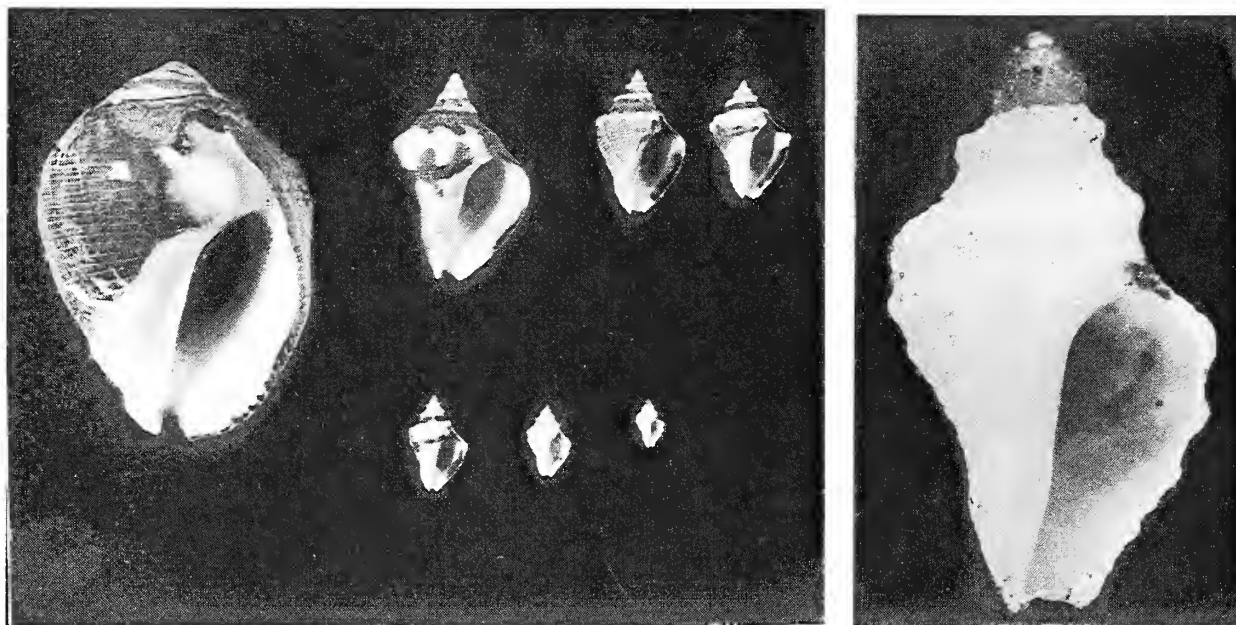
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Figures 1, 2. (1) Growth series of *Mancinella triangularis* (Blainville, 1832), Isla del Coco, Costa Rica, west side of Isla Muela ($5^{\circ}30'24.8''\text{N}$, $87^{\circ}04'01.0''\text{W}$), under rocks and dead coral heads, in 10-21 m, 20 March 1997, leg. K. L. Kaiser. (2) View of 3.2 mm shell shown in Figure 1 enlarged. Photos: David K. Mulliner.



Figures 3, 4. Growth series of *Thais (Tribulus) planospira* (Lamarck, 1822), Isla del Coco, Costa Rica, Roca Sucia ($5^{\circ}32'52.1''\text{N}$, $87^{\circ}04'55.0''\text{W}$), under rocks and in shakings, in 0-18 m, March 1997, leg. K. L. Kaiser. (4) View of 2.4 mm shell shown in Figure 3 enlarged. Photos: David K. Mulliner.



Figures 5, 6. (5) Growth series of *Thais (Vasula) melones* (Duclos, 1832), Isla del Coco, Costa Rica, Bahía Weston (between Bahías Chatham and Wafer) (5°33'N, 87°02'W), intertidal, on and under rocks at low tide, 25 May 1985, leg. K. L. Kaiser. (6) View of 4.4 mm shell shown in Figure 5 enlarged. Photos: David K. Mulliner.

A New Supplement to *The Festivus*

In 1984, *The Festivus* published the supplement, *Illustration of the Types Named by S. Stillman Berry in his "Leaflets in Malacology,"* by Carole M. Hertz. This paper has long been out of print and after many requests *The Festivus* is now publishing a revision of that paper.

The 43 page revision, *Illustration of the Types Named by S. Stillman Berry in his "Leaflets in Malacology" Revised*, also by Hertz, illustrates the 92 marine species described by Berry in his *Leaflets*, each with original orthography, updated list of repositories of Berry types, photo of the holotype or paratype of each species, and updated synonymies. The illustrations in this revision will be from the original photographs with better printing quality than in the original.

Included also, as in the original supplement, is a List of Genera Proposed in the "*Leaflets*", a summary of the cephalopod types named in the "*Leaflets*" and their repositories, literature cited, a bibliography of papers and an index to the species named by Berry in the "*Leaflets*."

The Supplement will be available after September 30th. The cost will be \$15 domestic, postpaid, and \$20 overseas surface mail. For those interested in ordering, send your check, on a US bank, payable to the San Diego Shell Club, % 3883 Mt. Blackburn Ave., San Diego, CA 92111, USA.

For further information, write, or e-mail the editor at: cmhertz@pacbell.net

AN EXCEPTIONALLY WELL PRESERVED SPECIMEN OF *ZOILA (GIGANTOCYPRAEA) GIGAS* (McCOY, 1867)

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A specimen of a very large fossil Australian cowrie (167 mm long, 113 mm wide, 90 mm high) in the collection of Donald Pisor of San Diego, was recently brought to my attention by Kim Hutsell. An examination of the specimen reveals that it is an exceptionally well preserved specimen of *Zoila (Gigantocypraea) gigas* (McCoy, 1867) (Figures 1-3).

Zoila (G.) gigas was described by McCoy (1867) from the lower Miocene Muddy Creek beds near Hamilton, Victoria, Australia. The species is characterized by its very large size (150-215 mm), very broad fossula, protruding spire, and rostrate extremities (Schilder, 1934). The stratigraphic range of *Z. (G.) gigas* is lower to upper middle Miocene (Darragh, 1985).

The collection data for the Pisor specimen states that it is from the Muddy Creek beds, of Victoria, Australia, the type locality. During a recent trip to Australia, I had the opportunity to visit the site where the Pisor specimen was found with the person who found it. I was able to ascertain that the specimen is from the same horizon as the type specimen. Most of the specimens in museum collections are internal molds with limited amounts of shell material. Extremities are rarely preserved.

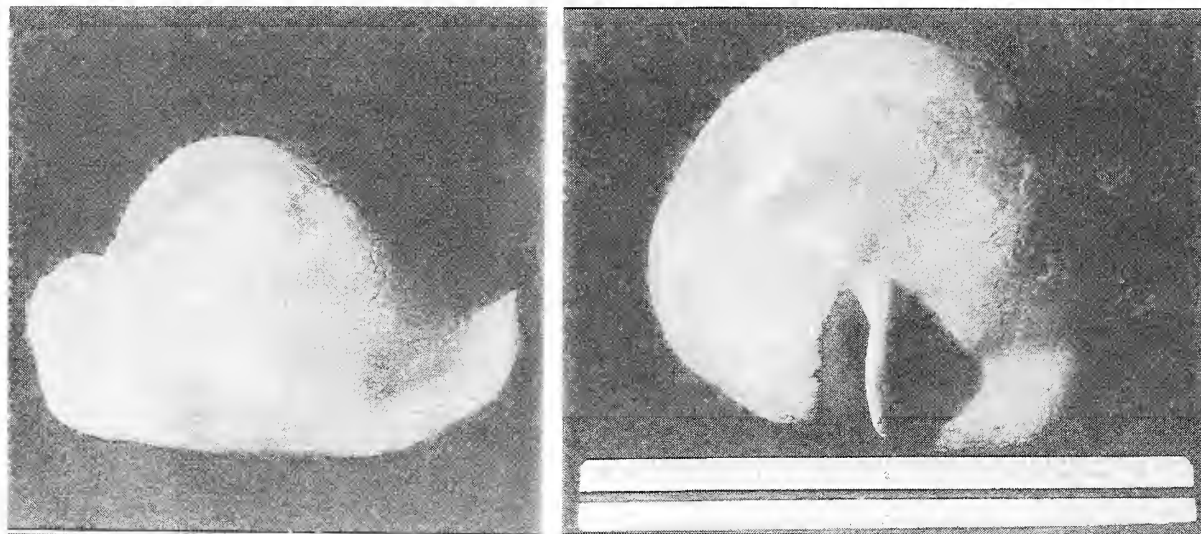
The Pisor specimen retains all of the shell material, clearly shows all of the diagnostic features of the species and still retains some patches of gloss (Figures 1-3). The specimen compares well with the most accessible illustration (Lorenz & Hubert, 1993, pl. 166, fig. 2). It is the best preserved specimen that I have ever seen.



Figure 1 *Zoila (Gigantocypraea) gigas*, ventral view showing dentition and fossula. Photo: Kim Hutsell.

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Figures 2, 3. *Zoila (G.) gigas*. (2) Lateral view showing the rostrate extremities.(3) Posterior view showing protruding spire. Photos: Kim C. Hutsell.

REPORT OF THE 1999 COA CONVENTION

KIM C. HUTSELL

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The 1999 convention of the Conchologists of America was held in Louisville, Kentucky. The lack of a local club to sponsor this year's event was no deterrent to a highly successful meeting. Through the hard work and determination of Lynn Scheu, Gene Everson and a host of other COA members, attendees were treated to a full slate of field trips, silent auctions, parties, displays, and programs that were as varied as they were interesting. Program topics ranged from freshwater mussels of the Midwest to cowries in collection of the Sanibel Shell Museum; from digital shell photography to updates in *Marginella* systematics. There was something for everyone. Field trips included fossil collecting, freshwater collecting, antiquing in area shops, and a visit to the Churchill Downs, home of the famous Kentucky Derby. As if all of that wasn't enough, the Shell Derby offered some fabulous shell

displays from members' collections. The convention concluded with Emily Vokes of Tulane University as guest speaker at the banquet.

As a side note, each year at the convention, a meeting is held for representatives of member shell clubs. This year the main topic was concern over the diminishing number of new members in clubs and what actions are being taken to renew interest in conchology. There was a general consensus that increased efforts to reach the general public, especially young people, is vital to the survival of existing clubs. One avenue discussed was to the effort to increase the availability and appeal of programs on video tape for club presentations. Another was to make more shells or "shell kits" available to schools. Whatever the course of action, it is clear that some type of cooperative effort is needed if our hobby is to survive.

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THE FESTIVUS

A publication of the San Diego Shell Club

ISSN 0738-9388

Volume: XXXI

October 14, 1999

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Photographer	David K. Mulliner

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c/o 3883 Mt. Blackburn Ave., San Diego, CA 92111, USA.

The *Festivus* is published monthly except December.
The publication date appears on the masthead above.
Single copies of this issue: \$5.00 plus postage.

Website at: <http://www.molluscs.net/SanDiegoShellClub/index.html> Email: cmhertz@pacbell.net

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<i>Emerita, Tulane University, New Orleans</i>

Meeting date: third Thursday, 7:30 PM,
Room 104, Casa Del Prado, Balboa Park, San Diego

PROGRAM

The Diamond Island Expedition

Kim Hutsell, Club member, dealer and author will
give an illustrated account of his recent collecting trip to the

football-sized Diamond Island in the middle of the Coral Sea
about 200 miles from the Great Barrier Reef.

Meeting date: October 21, 1999
Shells of the month: volutes

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CLUB NEWS

The Annual September Party

What fun we all had! About 30 people got together at the Arnold's (once again) and enjoyed a happy time with each other and sampling the delectable goodies provided for the grazing party. It's always amazing how the foods balance out into hot dishes, salad type contributions and the very important desserts. There were wonderful munchies in all categories — even a big birthday cake for Delbert Klaus.

The Arnold's deck is a perfect place for casual schmoozing. And choosing beverages was very convenient with several coolers (labeled with their contents) near the wine. Then there's Terry's collection in a room off the deck for those who couldn't be away from shells, fossil or Recent, for very long. Conversation flowed as if members hadn't seen each other for eternities. There never does seem to be enough time to just chat at meetings. Members lingered not really wanting to end the evening.

Our thanks to Marty and Terry Arnold for being great hosts and being willing to be invaded for the fifth year in a row!

New Member

Perini, Maurizio A., Via Pedrazza, 9, I-36010 Zane (VI), Italy. E-mail: mperini@witcom.com

Changes of Address

Luther, Douglas S., 1535 Ipukula St., Honolulu, HI 96821-1419, (808) 377-5173.

Norrid, Charlotte & Hal, (correction of e-mail address) HCNORRID2@aol.com

A New Supplement to The Festivus

In 1984, *The Festivus* published the supplement, *Illustration of the Types Named by S. Stillman Berry in his "Leaflets in Malacology,"* by Carole M. Hertz. This paper has long been out of print and after many requests *The Festivus* has now published a revision of that paper.

The 43 page revision, by Hertz, illustrates the 92 marine species described by Berry in his *Leaflets*, each with original orthography, updated list of repositories of Berry types, photo of the holotype or paratype of each species, and updated synonymies. The photos in this revision are from the original photographs and with better printing quality than in the original. Included also, as in the original supplement, is a List of Genera Proposed in the *Leaflets*, a summary of the cephalopod types in the *Leaflets* and their repositories, a bibliography of papers in the *Leaflets*, literature cited, and an index to the species named by Berry in the *Leaflets*.

Unlike previous supplements of *The Festivus*, this will not be sent free of charge to members, since many already have the original 1984 issue and might not be interested in a revised copy.

However, the Supplement is now available for purchase. The cost is \$15 domestic, postpaid, and \$20 overseas surface mail. For those interested in ordering, send your check, on a US bank, payable to the San Diego Shell Club, % 3883 Mt. Blackburn Ave., San Diego, CA 92111, USA.

Copies will be available at the October meeting for those who may wish to view and/or purchase one.

IN MEMORIAM

Constance E. (Connie) Boone
December 3, 1917 - September 13, 1999

HALIOTIS QUEKETTI (SMITH, 1910) FROM NORTHEAST SOMALIA: A RANGE EXTENSION OF 4,000 KM

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University of Southern California, Los Angeles, CA 90089-0371, USA
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DON PISOR

817-D West Harbor Drive, San Diego, CA 92101, USA

The waters of Somalia have proven to be a rich source of molluscan specimens. Many unusual and some new species have been reported from this area (e.g., Lorenz, 1989; Briano, 1993; Petit & Harasewych, 1993; Moolenbeek & Dekker, 1994). *Haliotis queketti* Smith, 1910, is a rather rare species of abalone so far known mainly from the eastern coast of the Republic of South Africa (Figures 1a-c). Specimens have been found from Coffee Bay, Transkei, to Palm Beach, Natal (Geiger, in press). These indications are confirmed by published range data (Kilburn & Rippey, 1982; Abbott & Dance, 1983; Muller, 1984, 1986; Richards, 1987). Further localities cited in the literature are Inhaca Island, off Mozambique (Macnae & Kalk, 1958); Natal, Isezela; Port Alfred; Natal, Zululand, off O'Neill Peak; and Mozambique, Delagoa Bay (= Bahia de Lourenco Marques) (Barnard, 1963). The species can be readily identified by the round overall shape, the rather central apex, the broad columella, the highly elevated holes, and the small, but strong scales on the broad, square, spiral cords. The coloration is very variable, from bright orange as it is also well-known from *H. parva* Linnaeus, 1758, to green and burgundy tones; most specimens are mottled (Figure 1a).

DP recently received an unidentified specimen of *Haliotis* from northeast Somalia, trawled at 80 - 100 m (Figures 1d-f). The specimen does not represent a typical *H. queketti*, because most of the dorsal surface of the shell is smooth and even a little shiny (Figure 1d). However, the overall shape, the position of the spire, the strongly elevated holes, and the broad

columella, allowed us to identify the specimen as *H. queketti*. Additionally, the dorsal shell closest to the apertural margin shows the strong cording with the fine scales typical for *H. queketti*. Comparison to other species from the east African region did not suggest an alternative identification of this specimen. *Haliotis unilateralis* Lamarck, 1822, was recently discussed by Geiger (1996). This species occurs from the northern Gulf of Elat to Madagascar. It does not have the holes elevated to such an extent, the spire is more eccentric, and the spiral cords - if present - are much less prominent and rounded. *Haliotis pustulata* Reeve, 1846, and *H. rugosa* Lamarck, 1822, [see Herbert (1990) and Geiger (1996; 1998) for discussion of the status of these taxa] are found throughout the Red Sea to the northernmost eastern Republic of South Africa. Both have much sturdier shells with hardly elevated tremata and do not have any scales on the spiral sculpture. The shells are also far less curved as compared to *H. queketti*.

The Somalia specimen discussed here (Figure 1d) has some superficial resemblance to *H. varia* Linnaeus, 1758, an Indo-Pacific species with western distributional limit at the tip of India [see Geiger (1996) for discussion]. *Haliotis varia* has an extremely variable shell; a typical *H. varia*, however, can be distinguished from *H. queketti* by the elevation of the tremata, the usually thicker shell, and the narrower columella. The spiral sculpture in *H. varia* consists of more narrow, rounded cords and threads, not the broad and square cords seen in *H. queketti*. Previously Geiger (1996)

attributed most records of *H. varia* from East Africa to either *H. pustulata* or *H. unilateralis*. With the new find of *H. queketti* from northeast Somalia a further possible identity for the records of "*H. varia*" in East Africa can be given.

Unfortunately the Somalia specimen of *H. queketti* only came with the rather vague locality data of northeast Somalia. Nevertheless, the range extension for the species is considerable and on the order of 4,000 km.

ACKNOWLEDGMENTS

Lindsey Groves provided some of the references cited, and the anonymous reviewers helped to further improve the manuscript.

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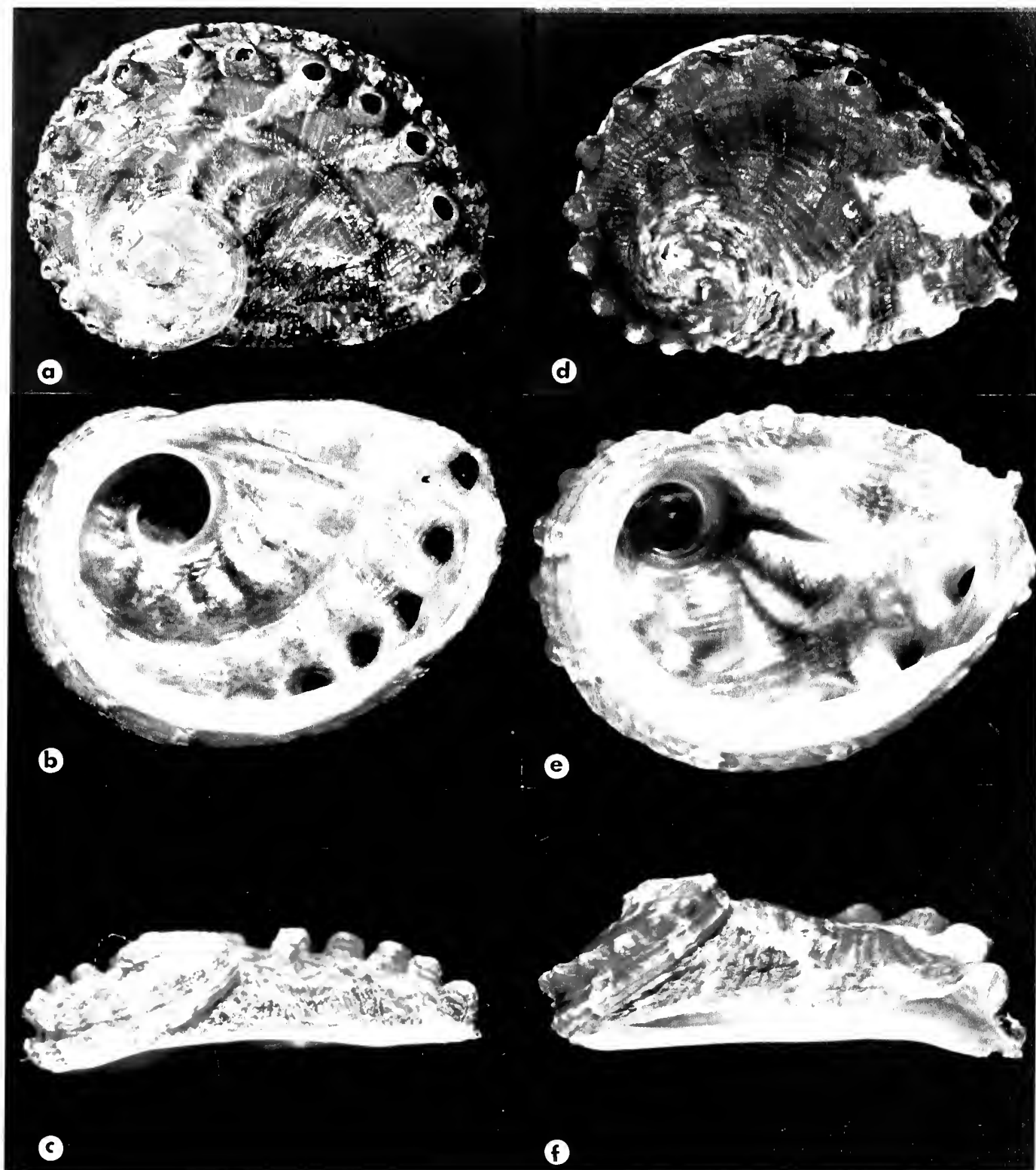


Figure 1a-c. Typical *Haliotis queketti* Smith, 1910. Collection Geiger AAB 52a. 29 mm. a: dorsal, b: ventral, c: apertural. Figure 1d-f. *Haliotis queketti* from northeast Somalia. Collection Pisor. 31 mm. d: dorsal. e: ventral. f: apertural.

LITTORARIA (LITTORARIA) VARIEGATA (SOULEYET, IN
EYDOUX & SOULEYET, 1852) (GASTROPODA: LITTORINIDAE)
FOUND AT BARRA DE NAVIDAD, COLIMA, MÉXICO

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Reid (1999) did an extensive study of the genus *Littoraria* Griffith & Pidgeon, 1834, in the tropical eastern Pacific. He reported a wide distribution for *Littoraria* (*L.*) *variegata* (Souleyet, in Eydoux & Souleyet, 1852): "The known northern limits are Laguna Ojo de Liebre on the western coast of Baja California (27°45'N, USNM), La Paz (24°10'N, Pilsbry & Lowe, 1932) and Topolobampo in the Gulf of California (25°36'N, BMNH)." He reported the "southernmost record is Puerto Pizarro, Tumbes, Perú (3°34'S, Peña, 1970, 1971)," and stated that "between Nayarit, México, and El Salvador there is a gap of over 2000 km with no records."

Between 1979 and 1985, Rodríguez Cajiga (1993) did a comprehensive investigation of the coastal lagoon of Barra de Navidad, Colima, México. He produced a checklist that included only two species of littorinids, *Littorina aspera* and *L. modesta*. It was during the time of the Rodríguez study (September 1989) that I collected several *Littoraria* (*L.*) *variegata* intertidally in the brackish water lagoon of Barra de Navidad. They were living in exposed silty sand among mangroves. This record reduces the gap from the north more than 250 km. Two of the specimens are shown in Figure 1.

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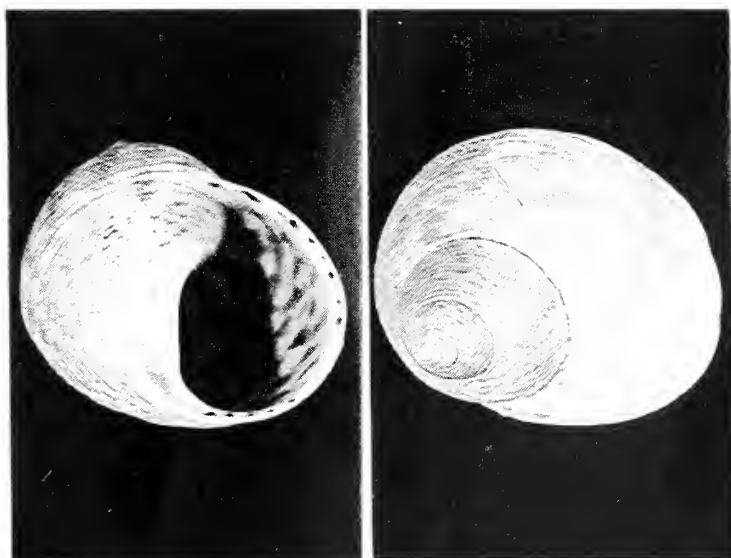


Figure 1. *Littoraria* (*Littoraria*) *variegata*, apertural and dorsal views. Left specimen, 23.1 mm L, right specimen, 25.5 mm L, collected at Barra de Navidad, Colima, México, leg. K. L. Kaiser, September 1989, K. L. Kaiser Collection. Photo: David K. Mulliner.

¹Mailing address: Paseo de las Conchas Chinas #115, dept. 4, Puerto Vallarta, Jalisco, C. P. 48390, México.

GROWTH CHANGES IN THE MURICID *DERMOMUREX OBELISCUS* (A. ADAMS, 1853)

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This is the second in a planned series of papers on growth series in molluscan species. The first article by Kaiser (1999, vol. 31(9): 98-100) dealt with three muricid species and this second note also treats a species in the Muricidae.

Small specimens of *Dermomurex obeliscus* (A. Adams, 1853) are so different from adult shells that they are difficult to identify. The five specimens of *D. obeliscus* shown in Figure 1 are from La Cruz de Huanacastle, Nayarit, México (21°25.997'N, 105°12.359'W). The four largest specimens were collected dead with hermit crabs in the intertidal zone on rocks by Carol Skoglund from December 1967 to February 1983. The smallest specimen was found dead at a -.21 m low tide at the same locality. It was collected by Carole and Jules Hertz in February 1999.

Keen (1971) gives the distribution of the species as the Mazatlán area in México to Masachapa, Nicaragua.

Radwin & D'Attilio (1976) included Costa Rica in the range and Vokes (1985) extended it to Panamá.

The species attains a length of 34.7 mm (Hutsell & Hutsell, 1999). The sizes of the figured shells are, from left to right, 7.1, 10.5, 12.2, 12.4 and 20.5 mm.

The three smallest specimens have six slender varices on the body whorl. As the shell grows these varices become flattened and broader as in the fourth specimen. In the mature 20.5 mm shell, there are only three major broad, flattened varices on the body whorl.

In all but the smallest specimen, there are three broad, raised spiral cords on the body whorl which cross the varices. In the 12.4 mm shell, the reddish brown lines between the raised cords become apparent and in the largest shell, these brown lines are strong but discontinuous where the shell has become eroded.

It would not be difficult to misidentify one of the smallest specimens — I did!



Figure 1. *Dermomurex obeliscus*. Growth series of specimens (left to right) 7.1, 10.5, 12.2, 12.4 and 20.5 mm. Photo: D. K. Mulliner.

¹Mailing address: 3883 Mt. Blackburn Ave., San Diego, CA 92111, USA

ACKNOWLEDGMENTS

My thanks go to Carol Skoglund for the loan of the four specimens and to David K. Mulliner for the photography.

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BOOK NEWS

Common Land Snails of Los Angeles County California

By: Joe Cocke. 1995.

Publisher: Joe Cocke.

136 pages, soft cover, 6 x 8½, spiral bound

Price: \$6.00 plus \$2.00 postage (domestic)

This is a fine little book, well illustrated by the author, for those interested in terrestrial snails of Los Angeles County and southern California. The first 25 pages give general background information. Classification, feeding, reproduction and habitat of land snails with information on cleaning and collecting snail shells are included along with pages on Snails as Pets and Snail Pest Control. A brief general glossary is found at the end of the book.

The book treats 34 species arranged from the most common (nos. 1-23) to the least common (24-34) and within the groups from the largest to smallest. Each species is illustrated by one to three line drawings placed on the page facing the description. Each description includes common and scientific name, size, shape of shells and number of whorls, umbilicus, lip, color and texture, habitat, distribution, similar species, and notes.

Joe Cocke has given the land snail enthusiast a handy identification guide, small enough to be carried on walks with print large enough to read easily in the field, even by those of us slightly vision-challenged. The modest price makes this guide available to anyone who is interested in terrestrial mollusks.

To order, write to Joe Cocke, 417 Calle Major, Redondo Beach, CA 90277

Carole M. Hertz

Tom Rice's A Sheller's Directory of Clubs, Books, Periodical and Dealers. 1999-2000.

Publisher: Of Sea & Shore Publications

111 + pp., soft cover, spiral bound

Price: \$6.95 plus \$1.50 postage US, or \$1.75 elsewhere (surface).

This 23rd edition of the Directory provides much information to the collector and dealer, making it possible to contact clubs and dealers throughout the world.

The very necessary index to the Directory (p. 4) guides the reader to the pages with the information in its different categories including "Shells on Stamps", and dealer ads. The book listings are sprinkled throughout the Directory under their geographic areas, and the "Periodicals" heading (p. 108) lists only 16 entries, with other periodicals, such as *The Festivus* (p. 83) listed only under "Clubs" or "Societies". This makes finding some entries very trying.

This guide will be available in the Club library at the October meeting.

To order, send to: P.O. Box 219, Port Gamble, WA 98364, USA, or e-mail: ofseashr@sinclair.net

Carole M. Hertz

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THE FESTIVUS

A publication of the San Diego Shell Club

ISSN 0738-9388

Volume: XXXI

November 11, 1999

Number: 11

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Emily H. Vokes	<i>Emerita, Tulane University, New Orleans</i>

Meeting date: third Thursday, 7:30 PM,
Room 104, Casa Del Prado, Balboa Park, San Diego

PROGRAM

Paleontology of the Imperial Formation in the Southwestern Colorado Desert of California

Dr. Thomas A. Deméré, Curator of Paleontology at the San Diego Natural History Museum, will give an illustrated	talk on field work in the Imperial Formation in the southwestern desert. He will also have a display.
-----------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------

Election of Officers for 2000

Mini-auction of Books

Meeting date: November 18, 1999

Shells of the month: fossils from San Diego desert areas

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CLUB NEWS

Minutes of the San Diego Shell Club Meeting - October 21, 1999

President Terry Arnold opened the meeting at 7:45 p.m. by welcoming everyone. The minutes of the September meeting were approved and Terry presented the slate of candidates offered by the board for the year 2000. They are as follows: President, Mike Mason; Vice-president, Kim Hutsell; Recording Secretary, Silvana Vollero; Corresponding Secretary, Mark Scott; Treasurer, Linda Hutsell. Nominations from the floor will be accepted at the November meeting prior to the election of officers.

Carole Hertz announced that the new supplement revising the Berry catalogue has been published. The price is \$15.00 per copy. Kay Klaus is the new Club librarian [see column 2]. Jules Hertz, told about this year's Christmas party [see column 2]. Terry began to solicit donations for the Auction in April and George Kennedy announced that Pat Abbott has a new book out called *The Rise and Fall of San Diego*. It costs \$16.95 and George had a copy for people to see at the meeting.

Mike Mason introduced the speaker for the evening, Kim Hutsell, who discussed his extended trip to Diamond Island in the middle of the Coral Sea. The most notable aspect of the trip was that no one had collected there before. The island is about the size of a football field and its only structure is a lighthouse. The boat, the *Tura*, departed from Gladstone and encountered rough seas most of the way. The water, however, was very clear and the temperature was about 78°F. In addition to diving, four dredges were in the water constantly. They found *Voluta perplicata* that had not been collected for about twenty years and collected a wide variety of species, even an uncommon octopus for a scientific institution in New Zealand. The many pounds of beach drift collected was about 40% shells. In sum, it was a long but very successful trip and a wonderful program for those in attendance.

The winner of the door prize was Jules Hertz. The meeting was adjourned to look at the shell display from Kim's trip and to enjoy the refreshments contributed by Larry Catarius and Wes Farmer.

Silvana Vollero

A New Club Librarian

Margaret Mulliner has asked to retire as Club

librarian and the Club gratefully thanks her for her many years of service. The lending library is one of the strengths of the Club. Many books and periodicals, old and new, are available for circulation by members. Margaret has faithfully had the Club's journals bound and suggested purchases to update the Club's holdings. Just last year she and Kim Hutsell put out a new pamphlet listing all the material in the library.

We welcome new librarian, Kay Klaus, who is enthusiastic about continuing to keep our Club library actively used and updated.

The Annual Club Christmas Dinner Party

The Club's annual Christmas dinner party will be held on Saturday evening December 4th in the Montfield Room of the Sheraton Four Points Hotel beginning at 5 p. m. with no host cocktails and socializing. Dinner will be at 6 p.m. and the program will begin after dessert.

The menu for the party is as follows: Salad: California greens with spinach and hearts of palm, choice of dressing. Choice of entree: Chicken breast stuffed with spinach, mushrooms and sun dried tomatoes in a garlic cream sauce or Oven roast pork loin, shallots, brandy, garnished with mixed wild mushrooms. A vegetarian plate is also available. Dessert: White chocolate mousse with fresh strawberries, cookie wafer. Rolls, butter, coffee or tea. The Club will, as always, provide dinner wine. The total cost (tax/gratuity included) is \$25 per person.

Following dessert will be the installation of officers. Then we will be privileged to view a slide program by member and professional photographer, Richard Herrmann, entitled *San Diego: Natural Beauty in Every Direction*. Richard will take us from the desert, to the mountains to the underwater off San Diego. It is a special program.

After the program will be the Club's traditional gift exchange. To participate in the gift exchange, bring a gift wrapped shell to place under the tree, with only the most general locality listed on the outside, *ie* eastern Pacific, western Atlantic etc. The Christmas party is a very joyous occasion. Do plan to come!

Reservations must be received by November 30th. Make checks payable to the Club and list your entree choices on your check. Give your check to Linda Hutsell at the November meeting or mail to the Club address [see front page].

THE GENUS *ALEXANIA* (GASTROPODA: EPITONIIDAE) IN THE GOLFO DE CALIFORNIA, MÉXICO

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The first report of *Alexania* in the Golfo de California, México, was the result of a field trip to Puerto Lobos, Cabo Tepoca, Sonora, México, in May 1973, by a group from Phoenix, Arizona. The late Mert Goldsmith found three beach-washed specimens, ranging from 5.0 to 7.5 mm in height, which he later sent to Joseph Rosewater of the National Museum of Natural History, Smithsonian Institution, for help with identification. Dr. Rosewater returned the shells to

Mert Goldsmith with the name *Alexania floridana* (Pilsbry, 1945). Rosewater's (1976) paper on a survey of Panamá cites the species from both ends of the Panama Canal without specifying the species name or mentioning the collecting locality.

An article by Robert Robertson (1997) on the first record of *Alexania floridana* from Texas had me pulling material out of my collection. I have one live-taken specimen (Figure 1) from about a minus 3 ft tide level

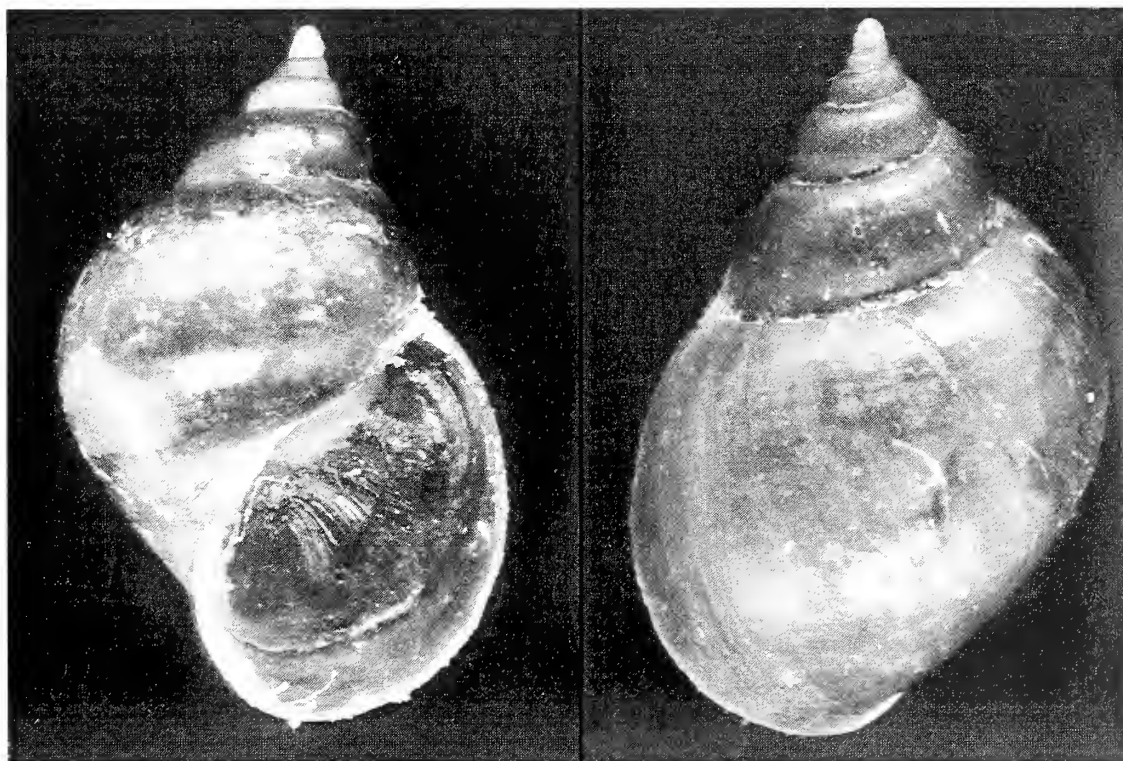


Figure 1. *Alexania floridana*, 4.6 mm, 2 views, from Bahía la Cholla, Sonora, México. Photo: D. K. Mulliner.

¹ 3845 E. Highland Ave., Phoenix, AZ 85018, USA

from a rocky area at Bahía la Cholla, Sonora and one from drift at Playa Tesoro, just south of La Paz, Baja California Sur, México. The three shells collected by Goldsmith at Puerto Lobos are also in the Skoglund Collection.

Robertson's article has a nomenclatural history of the species as well as drawings of the type specimen and a photograph of the shell found in Texas. One of the points he made is that the genus *Alexania* is closely related to *Recluzia*, and like *Recluzia*, may very well be a single species with a circumglobal distribution. He stated that the currently known distribution includes the Indo-Pacific, the eastern Pacific and a very few places in the western Atlantic.

If further study proves that there is only one species, the earliest name would be *Alexania natalensis* (Tomlin, 1926). Since this is still under consideration, my specimens are under the name *Alexania floridana*. These three lots establish the presence of the genus

throughout the Golfo de California.

ACKNOWLEDGMENTS

My thanks go to Robert Robertson of the Philadelphia Academy of Sciences for reading this manuscript and for confirming the identifications of the specimens involved and to David K. Mulliner for the excellent photographs.

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FOURTH ANNUAL GATHERING OF THE SOUTHERN CALIFORNIA UNIFIED MALACOLOGISTS (SCUM)

Saturday January 15, 2000

Munk Seminar Room--10 AM
Institute of Geophysics & Planetary Physics,
Scripps Institution of Oceanography
La Jolla, California 92093

Host: Hugh Bradner

SCUM is an informal association of professional, amateur, and student malacologists and paleontologists in southern California who are active or interested in research on mollusks. The continuing purpose of the annual gathering is to facilitate contact and keep one another informed of research activities and opportunities. There are no dues, officers, or publications. Previous SCUM gatherings at San Diego State University (SCUM I, 1997), Natural History

Museum of Los Angeles County (SCUM II, 1998), and National University, La Jolla (SCUM III, 1999) were highly successful events.

All persons interested in Recent and/or fossil mollusks are invited to attend. Presentations and discussions should be informal and briefly cover research interests. A slide projector and overhead projector will be available for those wishing to treat their work in more detail. Pre-meeting coffee and donuts will be provided. For the lunch break, there are numerous restaurants and sandwich shops (especially the Cheese Shop) about a mile south of SIO off La Jolla Shores Dr. Parking will be available for a \$3.00 fee (good incentive to car pool). Maps and detailed directions to the meeting place will be provided (maps are also available on the IGPP home-page: <http://igpp.ucsd.edu>).

Please contact SCUM IV meeting host Hugh Bradner privately for further information. Hugh Bradner, 1867 Caminito Marzella, La Jolla, CA 92037. Tel.: (858) 459-7681; Fax: (858) 459-0657; E-mail: hbradner@ucsd.edu Hope to see you there!

SUGGESTED GENERIC ALLOCATION FOR A CALIFORNIAN COLUMBELLID

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In an effort to re-evaluate the generic allocations of all shell-bearing northeastern Pacific gastropods, it has been necessary to provide a limited number of new genera (McLean, in prep.). On the other hand, for some problematic species, the finding of affinity to existing genera is a more rewarding result. One such case is here detailed.

Genus *Decipifus* Olsson & McGinty, 1958

Type species: *D. sixaolus* Olsson & McGinty, 1958: 36.
Eastern Panama.

The southern Californian species "*Anachis*" *penicillata* Carpenter, 1864 (Figure 1) has until now not been satisfactorily assigned to a genus. It lacks the thickened final lip with denticles that is characteristic of *Anachis* and its numerous subgenera, as treated by Keen (1971: 576). Grant & Gale (1931: 686) used *Chauvetia* Monterosato, 1884, as a subgenus of *Anachis*, but this is a genus now understood to be buccinid (see Wenz, 1938: 1207). Earlier (McLean, 1969, and 1978, fig. 25-4), I assigned "*Anachis*" *penicillata* to *Nassarina* (s.l.), following the advice of the late A. M. Keen, who treated it (1971: 596) as "?*Nassarina* (*Zanassarina*) *penicillata*." She included the question mark to suggest that its assignment remained questionable. The problem is that all subgenera of *Nassarina*, as treated by Keen (1971) also have lip denticles, whether strongly or weakly developed, so the allocation of the species to any of the subgenera of *Nassarina* is not a satisfactory solution. Both Keen (1971) and McLean (1968, 1979) seem to have overlooked the genus *Decipifus* Olsson & McGinty, 1958, which has a Caribbean type species and was initially introduced for an eastern Pacific species by McLean (1959: 10). *Decipifus* provides an allocation for the species

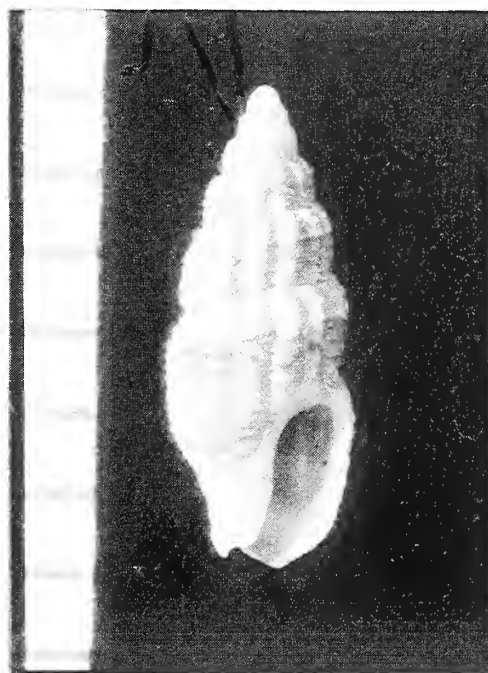


Figure 1. *Decipifus penicillata* (Carpenter, 1864). LACM 64073. Height 6.0 mm. Palos Verdes, Los Angeles County, California.

"*Anachis*" *penicillata*. Four tropical eastern Pacific species were placed in *Decipifus* by Keen (1971: 587). The genus was further treated by Radwin (1978: 325).

All species have rounded whorls with moderately impressed sutures, with axial ribs overridden by narrow spiral cords; a short, deeply notched anterior canal and a simple outer lip with no lirae or denticles. Intersections of the axial and spiral cords produce beads in some species.

The newly added species *D. penicillata* ranges from southern California to the entire outer coast of Baja California. Type material of *D. penicillata* was illustrated by Palmer (1958: 211, pl. 23, figs. 4-6).

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FOURTH EDITION OF THE INTERNATIONAL CODE OF ZOOLOGICAL NOMENCLATURE

The new and extensively revised 4th edition of the *International Code of Zoological Nomenclature* will come into effect on 1 January 2000 and will entirely supersede the current (1985) edition. The current edition is in effect until then. "The new edition ...favour stability in the usage of names over strict chronological priority, providing always that taxonomic freedom of expression is maintained [and] support for proposals to enable zoologists to find automatic solutions for many cases in which, under earlier editions of the code, the only recourse was to seek a ruling from the Commission" Some notes about the forthcoming edition, which contains many new provisions, will be found on the Commission's Website (www.iczn.org).

The price of the 4th Edition is £40 or \$65; the following discounts are offered: Individual members of a scientific society ordering one copy of the Code for personal use are offered a discount of 25% (price £30 or \$48); the name and address of the society should be given. Postgraduate or undergraduate students ordering one copy for personal use are offered a discount of 25% (price £30 or \$48); the name and address of the student's supervisor should be given. Institutions or agents buying 5 or more copies are offered a 25% discount (price £30 or \$48 for each copy).

Prices include surface postage; for airmail please add £2 or \$3 per copy. Copies for delivery may be

ordered now from ITZN, c/o The Natural History Museum, Cromwell Road, London SW7 5BD, U.K. (e-mail: iczn@nhm.ac.uk) or from AAZN, Attn. D.G. Smith, MRC-159, National Museum of Natural History, Washington, D.C. 20560-0159, U.S.A. (e-mail: smithd@nmnh.si.edu). Payment should accompany orders. Checks should be made out to "ITZN" (sterling or dollars) or to "AAZN" (dollars only). Payment to ITZN can also be made by credit card (Visa or MasterCard only) giving the cardholder's number, name, address and the expiration date.

Individual purchasers of the Code are offered a 50% discount on one copy of the following publications for personal use:

The Official Lists and Indexes of Names and Works in Zoology (1985) - reduced from £60 to £30 and from \$110 to \$55;

Towards Stability in the Names of Animals - A History of the International Commission on Zoological Nomenclature 1895-1995 (1995) - reduced from £30 to £15 and from \$50 to \$25;

The Bulletin of Zoological Nomenclature (The Commission's quarterly journal) - discount valid for up to 5 years; for 1999 the discounted price would be £51 or \$90.

Translations of the Code are planned; availability will be announced on the Commission's Website."

A REVIEW AND EVALUATION FOR A RECORD OF
VEXILLUM SUBDIVISUM (GMELIN, 1791)
IN THE EASTERN PACIFIC OCEAN
(GASTROPODA: COSTELLARIIDAE)

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INTRODUCTION

This paper records the first report of a specimen representing the Indo-Pacific genus *Vexillum* (Costellariidae) in eastern Pacific waters. A single beach specimen of *Vexillum subdivisum* (Gmelin, 1791) was purportedly collected at Clipperton Island (10°17'00"N, 109°13'00"W) by Charles F. Harbison and Edwin (Ned) C. Allison, in 1958, while members of a Scripps Institution of Oceanography Expedition (Hertlein & Allison, 1960a: 94). The specimen (SDNHM catalog #42933) was donated to the San Diego Natural History Museum by Mr. Harbison, then Curator of Entomology.

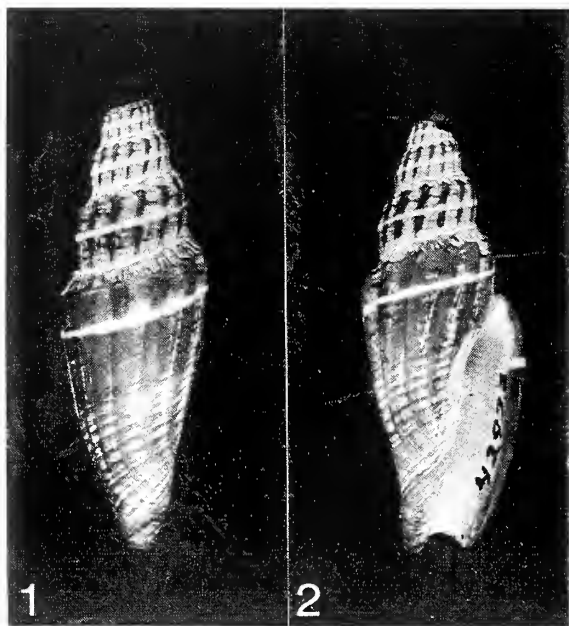
This costellariid gastropod, however, was not recorded by Leo G. Hertlein and Ned Allison (Allison, 1959; Hertlein and Allison, 1960a, 1960b, 1966, 1968) in their papers describing the gastropods obtained on the cruises to Clipperton Island by the Scripps Research Vessel Spencer F. Bird in 1956 and 1958. I suspect this specimen was not seen by Dr. Allison, as most of the specimens he collected at Clipperton Island were eventually deposited by him in the Museum of Paleontology at the University of California, Berkeley (Hertlein and Allison, 1968:1).

Vexillum subdivisum (synonyms: *V. nigrina* Lamarck 1811, *vide* Cernohorsky, 1969:966, fig. 18, and *V. costellaris* [Lamarck, 1811], *vide* Cernohorsky, 1969: 965, fig. 17) is a wide ranging Indo-Pacific species, with populations in the Indian Ocean and the southwest Pacific Ocean. In the western Pacific Ocean, the taxon commonly occurs in the Philippine Islands (AMNH, 15 lots) and is known from Malaysia

(Singapore, AMNH 217801), Salah (North Borneo, Malawali Island, AMNH 150853), the Solomon Islands (Suu, Malaita [Sikaiana], AMNH 188910), the New Hebrides [Vanuatu] (Tasmalon, Espiritu Santo Island, USNM 769285), and Fiji ("Viti Islands", USNM 8077, ex-Garrett). Records of this species from the Society Islands (Tahiti, Dautzenberg & Bouge, 1933: 175, ex-Canque, 1910) are probably referable to *Vexillum lyratum* (Lamarck, 1822), not *V. costellaris*. The specimen identified by Abbott and Dance (1982: 206) as *V. subdivisum* is referable to *V. lyratum*, whereas their *V. subdivisum* form *costellaris* is actually *V. subdivisum teste* Rosenberg (*in litt*). Therefore, I have not been able to find records of this taxon in French Polynesia (Tuamotu Archipelago, the Marquesas Islands, or in the Line Islands). However, the presence of this species in the Society Islands would have suggested that it might have reached these more eastern insular outposts in the central Pacific. Populations occurring on these Polynesian islands appear to serve as potential centers of dispersal on the Pacific Plate for larval mollusks to reach Clipperton Island. It now seems that the specimen believed to be from Clipperton has mislocalized data (*teste* Salisbury *in litt.* and Rosenberg *in litt.*).

The Clipperton specimen (Figures 1, 2) lacks the early whorls of the spire owing to breakage but otherwise appears to be a "typical" example of the form of *Vexillum subdivisum* (Gmelin) also named by Lamarck (1811) as *Vexillum costellaris* (Tryon, 1882: Mitridae pl. 49, fig. 408).

ZOOGEOGRAPHIC CONSIDERATIONS



Figures 1, 2. Specimen of *Vexillum subdivisum* (Gmelin, 1791) labeled from "Clipperton Island, Collected by Harbison & Allison, 1958;" San Diego Natural History Museum, #42933, x1. [See Abbott & Dance (1982: 206) "*Vexillum subdivisum* form *costellaris*" for a colored illustration of this species.]

The presence of mollusks with Indo-Pacific faunal affinities at Clipperton Island and elsewhere in the tropical eastern Pacific Ocean has long been known and this distribution is well documented (Hertlein, 1937; for summary see Emerson, 1991: 67). Some workers until recently remained skeptical that viable populations of this faunal element exist in eastern Pacific waters other than through the agency of human transport. For example, Foin (1976: 33) offered a non-biological explanation for this dispersal: "A number of Indo-Pacific species have recently appeared around the Galapagos, Cocos Island, Clipperton Island, and in the Gulf of Panama (Emerson & Old, 1964, 1965, 1968; Bakus, 1968; Keen, 1971). This sudden appearance is not likely to be a sampling artifact, and it is difficult to see how a number of species have suddenly overcome the effects of the East Pacific Rise and thousands of miles of travel across deep ocean without speculating that adult shells have been carried on the hulls of ships traveling towards the Panama Canal." Clipperton Island and Cocos Island are not likely ports of call for vessels departing from the western Pacific to the Panama Canal and most ships supplying the Galapagos Islands

originate from ports in the western Americas. Furthermore, the presence of Indo-Pacific mollusks in eastern Pacific waters has been known for nearly 150 years (e.g. Carpenter, 1857: 346; Darwin, 1860: 391). Thus, Indo-Pacific faunal elements are not recent arrivals in the eastern Pacific in the historical context.

I first became interested in this distributional phenomenon when I worked briefly (1947, 1950) as an Aquatic Biologist at the Smithsonian Institution on the mollusks collected in 1946 and 1947 as a result of the U. S. Navy Crossroad Project, Bikini Survey (Marshall Islands). This period was the Golden Era of Cenozoic molluscan studies in Washington, D.C. In the Division of Mollusks of the U. S. National Museum at this time were Paul Bartsch, Harald A. Rehder, Joseph P. E. Morrison, and R. Tucker Abbott, and on the staff of the Geological Survey were Wendell P. Woodring, Julia A. Gardner, Harry S. Ladd, Ralph B. Stewart, F. Stearns MacNeil, Ellen J. Moore and David Nicol. Additionally, Frederick M. Bayer was a member of the Division of Marine Invertebrates. This experience as a student at this venerable institution had a lasting and profound influence on my professional career.

When preparing the molluscan specimens for cataloging, I noted that some of the species from the Marshall Islands had been reported from Clipperton Island. I discussed this subject with Dr. Morrison, who was my supervisor and who had collected most of the mollusks resulting from the Bikini Survey (some 209,000 specimens, *vide* Demond, 1957: 276). He advised me to ignore the western Pacific records at Clipperton, for these were based largely on records of badly worn beach specimens. He believed the specimens had been accidentally transported to Clipperton in the ballast of sailing ships visiting the island from central Pacific ports of origin. To Dr. Morrison this was a subject that did not merit further consideration. To him, the existence at Clipperton of south sea shells was a "no story," a non-biological event (cf. Gould, 1992: 12).

Not convinced by this argument, I continued my quest for knowledge on the subject and eventually collaborated with Leo George Hertlein (Hertlein and Emerson, 1953; 1957) and other "believers" (Zinsmeister & Emerson, 1979: 34). Time has shown the "non-believers" to be wrong. Subsequent field work has supported the biogeographic conclusions of the earlier investigators. The recent shore collecting, SCUBA diving, and dredging operations conducted at Clipperton Island (Beals, 1995; Small, 1994, 1995;

Kaiser, 1999) serve to confirm my early findings (Emerson, 1967: 88) that the shallow water molluscan fauna at Clipperton Island is about evenly divided between elements of the Indo-Pacific and Panamic faunal provinces, with a minor endemic element present as was evident in earlier collections (Bartsch & Rehder, 1939; Sachet, 1962; Salvat & Ehrhardt, 1970; Perrin, 1977; Emerson, 1994). The question remains, however, have the Indo-Pacific faunal constituents established reproductively viable populations that can endure hydroclimatically variable conditions such as El Niño events that confront marine life at Clipperton (cf. Kay, 1991: 244; Emerson & Chaney, 1995). Only continued field surveys of this isolated island can answer this question with certainty. However, it appears that species of *Vexillum* have yet to reach the eastern Pacific Ocean, although the genus is well represented in French Polynesia (Richard, 1985: 430, 431) and *Vexillum subdivisum* is not known to occur on the Pacific Plate.

ACKNOWLEDGMENTS

I am indebted to the late Walter E. Sage, III (AMNH) for informing me of the specimen of *Vexillum subdivisum* in the San Diego Natural History Museum. Regina Wetzer (SDNHM) kindly sent me the specimen on loan. The following generously provided data from their respective collections: Alan R. Kabat (U. S. National Museum of Natural History); Carole S. Hickman (Museum of Paleontology, U. C., Berkeley), Gary Rosenberg (Academy of Natural Sciences, Philadelphia); Silvard P. Kool (Museum of Comparative Zoology, Harvard University); James H. McLean and Lindsey Groves (Los Angeles County Museum of Natural History) and Richard Salisbury (Boise, Idaho). Andrew S. Modell (AMNH) provided the photographs and Stephanie Crooms (AMNH) word-processed the manuscript.

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